

Characterization Well R-12 Geochemistry Report



Produced by the Risk Reduction and Environmental Stewardship Division

Cover photo shows a modified Foremost DR-24 dual-rotary drill rig. The DR-24 is one of several drill-rig types being used for drilling, well installation, and well development in support of the Los Alamos National Laboratory Hydrogeologic Workplan. The Hydrogeologic Workplan is jointly funded by the Environmental Restoration Project and Defense Programs to characterize groundwater flow beneath the 43-square-mile area of the Laboratory and to assess the impact of Laboratory activities on groundwater quality. The centerpiece of the Hydrogeologic Workplan is the installation of up to 32 deep wells in the regional aquifer.

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*Characterization Well R-12
Geochemistry Report*

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List of Acronyms and Abbreviations

am	amorphous
amu	atomic mass units
bgs	below ground surface
°C	(degrees) Celsius
C	colorimetry
CVAA	cold vapor atomic absorption
DCG	derived concentration guideline
DOC	dissolved organic carbon
DOM	dissolved organic matter
DR	dual rotation
Eh	oxidation-reduction potential
E°	standard electrode potential in volts
EPA	(US) Environmental Protection Agency
ER	Environmental Restoration (Project)
ESP	Environmental Surveillance Program
GCMS	gas chromatography mass spectrometry
GEL	General Engineering Laboratory
HE	high explosive
HFO	hydrous ferric oxide
HSA	hollow-stem auger
IC	ion chromatography
ICPMS	inductively coupled argon plasma mass spectrometry
ICPOES	inductively coupled argon plasma optical emission spectroscopy
IDL	instrument detection limit
IRMS	isotope ratio mass spectrometry
ISE	ion selective electrode
J values	estimated values
JMML	Jemez Mountains meteoric line
LANL	Los Alamos National Laboratory
MCL	maximum contaminant level
MDA	minimum detectable activity
MEQ	milliequivalents
µS/cm	microSiemens per centimeter
MWL	(worldwide) meteoric water line
NMWQCC	New Mexico Water Quality Control Commission
NTU	nephelometric turbidity unit
pH	negative log ₁₀ activity of the hydrogen ion

ppt	precipitate
psi	pound-force per square inch
RCRA	Resource Conservation Recovery Act
SI	saturation index
TA	technical area
TD	total depth
TDS	total dissolved solids
TKN	total Kjeldahl nitrogen
TOC	total organic carbon
TW	test well
UDR	underground drilling rig

Metric to English Conversions

Multiply SI (Metric) Unit	by	To Obtain US Customary Unit
kilometers (km)	0.622	miles (mi)
kilometers (km)	3281	feet (ft)
meters (m)	3.281	feet (ft)
meters (m)	39.37	inches (in.)
centimeters (cm)	0.03281	feet (ft)
centimeters (cm)	0.394	inches (in.)
millimeters (mm)	0.0394	inches (in.)
micrometers or microns (μm)	0.0000394	inches (in.)
square kilometers (km^2)	0.3861	square miles (mi^2)
hectares (ha)	2.5	acres
square meters (m^2)	10.764	square feet (ft^2)
cubic meters (m^3)	35.31	cubic feet (ft^3)
kilograms (kg)	2.2046	pounds (lb)
grams (g)	0.0353	ounces (oz)
grams per cubic centimeter (g/cm^3)	62.422	pounds per cubic foot (lb/ft^3)
milligrams per kilogram (mg/kg)	1	parts per million (ppm)
micrograms per gram ($\mu\text{g}/\text{g}$)	1	parts per million (ppm)
liters (L)	0.26	gallons (gal.)
milligrams per liter (mg/L)	1	parts per million (ppm)
degrees Celsius ($^\circ\text{C}$)	9/5 + 32	degrees Fahrenheit ($^\circ\text{F}$)

CHARACTERIZATION WELL R-12 GEOCHEMISTRY REPORT

by

Patrick Longmire

ABSTRACT

This report provides analytical results for groundwater obtained during four characterization-sampling rounds conducted at regional aquifer well R-12 from September 2000 through September 2001. Well R-12 was sampled on September 18 through 20, 2000; March 14 through 16, 2001; June 13 and 14, 2001; and September 7 through 12, 2001. The goal of the characterization efforts at well R-12 was to assess the hydrochemistry and to determine whether or not contaminants are present in the perched zone and regional aquifer in the vicinity of the well. A geochemical evaluation of the analytical results for the well is also presented.

Characterization well R-12 is located in Sandia Canyon west of supply well PM-1 within Technical Area (TA)-72, Los Alamos National Laboratory (LANL or the Laboratory). Well R-12 is downgradient of multiple contaminant source areas that include potential release sites in the Sandia Canyon watershed. Well R-12 was completed on January 21, 2000.

Well R-12 is completed with a triple-screen well (459.0 to 469.0 ft; 504.5 to 508.0 ft; and 801.0 to 839.0 ft) with a Westbay® Instrument, Inc., MP55® monitoring system set in the Cerros del Rio basalt (screen #1), in older alluvium (screen #2), and in the Santa Fe Group basalt (screen #3). A perched water table was at a depth of 424 ft when the borehole was drilled, and the regional water table was at a depth of 805 ft.

Four rounds of groundwater characterization samples, collected from depths of 468.0, 507.0, and 811.0 ft in well R-12, were chemically characterized for radionuclides, metals and trace elements, major ions, high explosive (HE) compounds, total organic carbon (TOC), dissolved organic carbon (DOC), organic compounds, and stable isotopes (H, N, and O). Groundwater (filtered and nonfiltered) samples were analyzed using methods recommended by both the Environmental Protection Agency (EPA) and Environmental Restoration (ER) Project laboratories external to LANL.

Concentrations of dissolved manganese in groundwater samples collected from perched groundwater (screen #1) and the regional aquifer (screen #3) at well R-12 exceeded the New Mexico Water Quality Control Commission (NMWQCC) standard of 0.2 mg/L for domestic water supply. Concentrations of natural iron (screens #1 and #3) and manganese (screens #1, #2, and #3) also exceeded EPA drinking water secondary standards for total iron (0.3 mg/L) and total manganese (0.05 mg/L) in several samples. Elevated concentrations of natural manganese and iron probably result from reductive dissolution of ferric (oxy)hydroxide and manganese dioxide present in aquifer material under reducing conditions characteristic of residual drilling fluids present in well R-12. However, the standards established for these two metals are based on aesthetic properties such as taste, odor, and color. Concentrations of other metals and trace elements were below their respective maximum contaminant levels (MCLs) at well R-12 in screens #1, #2, and #3. Well R-12 is reequilibrating with groundwater as residual drilling fluid oxidizes into inorganic carbon. The chemistry of the groundwater collected from screens #1 and #3 has been influenced the most by residual drilling fluid.

Activities of tritium at depths of 468.0, 507.0, 811.0 ft ranged from 181–192, 78.2–111, and 49.8–82.7 pCi/L, respectively. This finding suggests that a component of sampled groundwater from both the perched and regional systems is less than 60 years old and postdates the beginning of nuclear testing (based on the cosmogenic baseline of tritium of 1 pCi/L prior to testing). Americium-241, cesium-137, plutonium-238, plutonium-239,240, and strontium-90 were not detected in groundwater samples collected from well R-12. Activities of uranium-234, uranium-235, and uranium-238 were detected only at concentrations less than 1.5 pCi/L. Gross alpha and gross beta activities were generally less than 7 pCi/L. Measurable gross gamma between 119 and 469 pCi/L was attributed to isotopes within the natural uranium-238, uranium-235, and thorium-232 decay chains.

The regional aquifer groundwater is characterized by a calcium-sodium-bicarbonate ionic composition. This groundwater, represented by four samples, was found to contain an average of 63.4 pCi/L tritium, 0.31 mg/L total Kjeldahl nitrogen (TKN), 0.0014 mg/L (1.4 µg/L) dissolved uranium, 0.66 mg/L dissolved manganese, 9.35 mg/L dissolved chloride, 0.36 mg/L dissolved fluoride, and 12.6 mg/L dissolved sulfate. Concentrations of nitrate plus nitrite (as N) were less than 0.2 mg/L. Concentrations of perchlorate were less than detection (0.001–0.004 mg/L) and the reporting limit (0.012 mg/L) in the regional aquifer.

Perched groundwater at well R-12 ranges from a calcium-sodium-bicarbonate to a sodium-calcium-bicarbonate ionic composition. Variation in ionic composition is influenced by cation exchange reactions between calcium and sodium. Bicarbonate forms strong complexes with uranium [U(VI)], which influences fate and transport of this metal. Carbonate alkalinity varies within the perched zone and regional aquifer because of the oxidation of organic carbon associated with residual drilling fluids. Perched groundwater, represented by eight samples, was found to contain an average of 141 pCi/L tritium, 1.31 mg/L dissolved ammonium (as N), 1.55 mg/L dissolved TKN, 0.00034 mg/L (0.34 µg/L) dissolved uranium, 0.269 mg/L dissolved manganese, 9.35 mg/L dissolved chloride, 0.51 mg/L dissolved fluoride, and 4.73 mg/L dissolved sulfate. Concentrations of dissolved nitrate plus nitrite (as N) were less than 0.3 mg/L in perched groundwater and the regional aquifer. Ammonium and TKN were the dominant nitrogen species present in the perched groundwater collected. Concentrations of perchlorate were less than detection (0.001–0.004 mg/L) and the reporting limit (0.012 mg/L) in the perched zone.

Stable isotope ratios of δD and $\delta^{18}O$ indicate that the sampled groundwater at well R-12 was derived from a local meteoric source consisting of meteoric water, although the source of recharge is different for both perched and regional aquifer groundwater. Results of $\delta^{15}N_{AIR-NO_3}$ analyses suggest that nitrate plus nitrite in the perched groundwater (507.0 ft) is derived from both treated sewage discharges (+10.2‰) within upper Sandia Canyon and dissociated nitric acid enriched in nitrogen-14 (-3.7‰). Ammonium and TKN within the perched zone are possibly derived from residual drilling fluid such as EZ-MUD® ($\delta^{15}N_{AIR-NH_4}$ of +1.5‰) and reduction (ammonification) of both biotic nitrate ($\delta^{15}N_{AIR-NH_4}$ of +5.6‰) and abiotic nitrate ($\delta^{15}N_{AIR-NH_4}$ of -6.1‰).

Reducing conditions with respect to nitrogen (ammonium and TKN) and manganese [Mn(II)] dominate in the perched zone because of the presence of organic reductants derived from the oxidation of drilling fluids. Chemical data collected during drilling of well R-12, however, show that native groundwater was oxidizing with respect to manganese and nitrogen. Reducing conditions enhance denitrification of nitrate and transformation of sulfate to hydrogen sulfide and other sulfur species.

Geochemical calculations using the computer program MINTEQA2 were performed to evaluate solute speciation, the effects of residual drilling fluid on water chemistry, and mineral equilibrium in assessing groundwater chemistry (natural and anthropogenic solutes) and to refine the geochemical conceptual model for well R-12. These calculations suggest that groundwater at well R-12 has not reached complete equilibrium with reactive solid phases in the perched zone and regional aquifer because of the presence

of residual drilling fluid. This interpretation is based on variations in saturation indices (SIs). Uranium(IV) is calculated to be stable as U(OH)_4^0 under induced reducing conditions characterized by elevated TOC and DOC at well R-12. As oxidizing conditions become reestablished during breakdown of drilling fluids, uranyl dicarbonate and tricarbonate complexes are stable in the regional aquifer at well R-12. The perched zone is characterized by variable saturation with respect to CaCO_3 , MnCO_3 , and FeCO_3 , and is oversaturated with respect to USiO_4 . Perched groundwater is calculated to be undersaturated with respect to amorphous silica phases or volcanic glass, BaSO_4 , and SrCO_3 . Increasing carbonate alkalinity, derived from oxidation of drilling fluids, and pH enhances saturation with respect to CaCO_3 (both calcite and aragonite) during initial sampling of the perched zone. Results suggest that the regional aquifer at well R-12 is characterized by variable saturation with respect to CaCO_3 and $\text{Ca}(\text{UO}_2)_2(\text{Si}_2\text{O}_5)_3 \cdot 5\text{H}_2\text{O}$ (haiweeite) and is undersaturated with respect to BaSO_4 , MnCO_3 , silica precipitate, FeCO_3 , and SrCO_3 . The regional aquifer groundwater is oversaturated with respect to USiO_4 and is calculated to be in equilibrium with silica gel.

1.0 INTRODUCTION

This report provides analytical results for four groundwater sampling rounds conducted at characterization well R-12. The goal of the characterization efforts at well R-12 was to assess the hydrochemistry and to determine if contaminants are present in the perched zone and regional aquifer in the vicinity of the well. The well is located in upper Sandia Canyon, in TA-72, within the Los Alamos National Laboratory, referred to as the Laboratory or LANL in this report (Figure 1.0-1) (Broxton et al. 2001, 71252). The Environmental Restoration (ER) Project installed well R-12 as part of groundwater investigations to satisfy requirements of the "Hydrogeologic Workplan" (LANL 1998, 59599) and to support the Laboratory's "Groundwater Protection Management Program Plan" (LANL 1995, 50124) and the Los Alamos Canyon and Pueblo Canyon work plan (LANL 1995, 50290).

Well R-12 was designed primarily to provide geochemical or water quality and hydrogeologic data for the regional aquifer and for a perched zone occurring within both the Cerros del Rio basalt and the underlying older alluvium. Well R-12 is downgradient of potential release sites in the Sandia Canyon watershed (LANL 1995, 50290). A geochemical evaluation of the analytical results for well R-12 is presented in this report.

Hydrogeochemical interpretations are also presented using analytical results for groundwater samples collected at well R-12. Discussion of other hydrogeochemical data collected within the Sandia Canyon watershed, however, is deferred until they can be evaluated in the context of sitewide information collected from other ER Project and Hydrogeologic Workplan characterization wells (i.e., R-11). Once all deep groundwater investigations in Sandia Canyon are completed, geochemical and hydrogeologic conceptual models for the watershed may be included in a groundwater risk analysis. These models will include an evaluation of potential contaminant transport pathways.

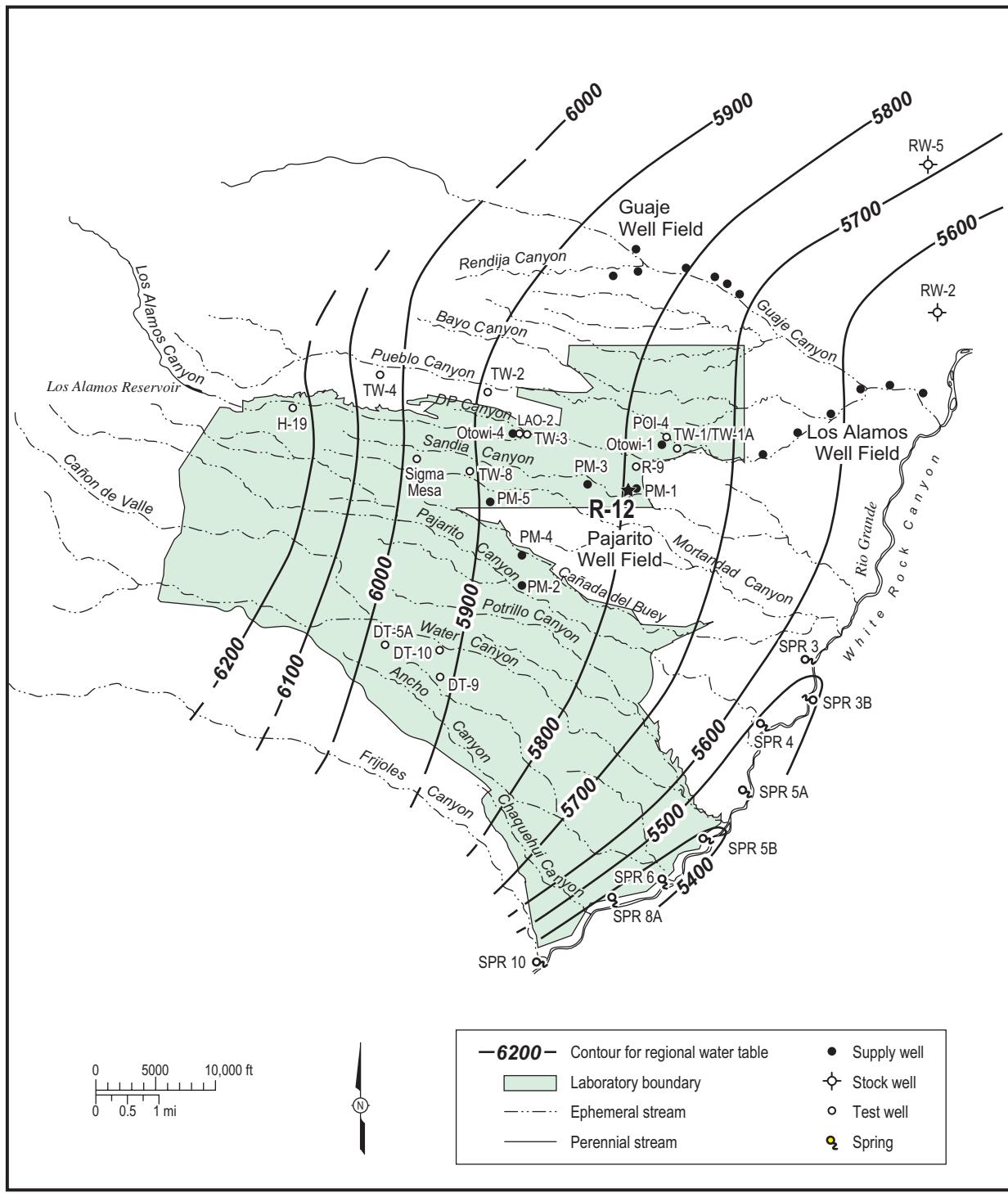
Although well R-12 is primarily a characterization well, its design and construction also meet the requirements of a Resource Conservation and Recovery Act (RCRA)-compliant monitoring well as described in the EPA document RCRA Groundwater Monitoring: Draft Technical Guidance, November 1992, EPA 530-R-93-001. Incorporation of this well into a Laboratory-wide groundwater monitoring program will be considered and will be more specifically evaluated (e.g., sampling frequency, analytes, etc.) when the results of well R-12 characterization activities are comprehensively evaluated in conjunction with other groundwater investigations in the "Hydrogeologic Workplan" (LANL 1998, 59599).

2.0 DRILLING METHODS AND WELL DESIGN

2.1 Drilling Methods

Well R-12 was drilled in two phases from March 10 to June 8, 1998, and from October 25, 1999, through January 21, 2000. An Ingersoll-Rand T-4 drill rig with a T-5 rotating head was used during the first phase of drilling to a depth of 847 ft, and a Foremost dual rotation (DR)-24 rig during the second phase and for well installation (Broxton et al. 2001, 71252). The borehole was completed to a final depth of 886 ft, and the permanent well was installed utilizing a Foremost underground drill rig (UDR). Well R-12 was completed on January 21, 2000.

During the second phase, to deepen the borehole from 847 to 886 ft, the casing-advance drilling method was used; in addition, drilling mud behind the casing was used for lubrication. TORKease® polymer, QUIKFOAM®, and EZ-MUD® bentonite slurries, mixed with community water obtained from a water line (spout) near the community landfill located at TA-3, were also used. These additives served to lubricate the outside of the casing system during drilling and to prevent binding of the casing string to the borehole wall.



Source: Purtyman 1984, 6513.

F1.0-1 / R-12 WELL COMPLETION RPT / 061200 / PTM

Figure 1.0-1. Locations of well R-12, selected water supply wells, test wells, and springs near the Rio Grande, and generalized water-level contours for the regional aquifer (from Broxton et al. 2001, 71252)

2.2 Well Design

Characterization well R-12 was designed as a triple-completion well with three wire-wrapped, stainless steel screens from 459.0 to 467.1 ft in the Cerros del Rio basalt, 504.5 to 508.0 ft within older alluvium, and from 801.0 to 839.0 ft within the Santa Fe Group basalt (Broxton et al. 2001, 71252). Figure 2.2-1 shows final construction information for well R-12. After well development, the Westbay® MP55 System® for groundwater monitoring was installed in the steel-cased well. Model 2523 MOSDAX® System sampler-probe equipment was used to collect groundwater samples from the completed well.

3.0 HYDROGEOLOGY

3.1 Hydrostratigraphy

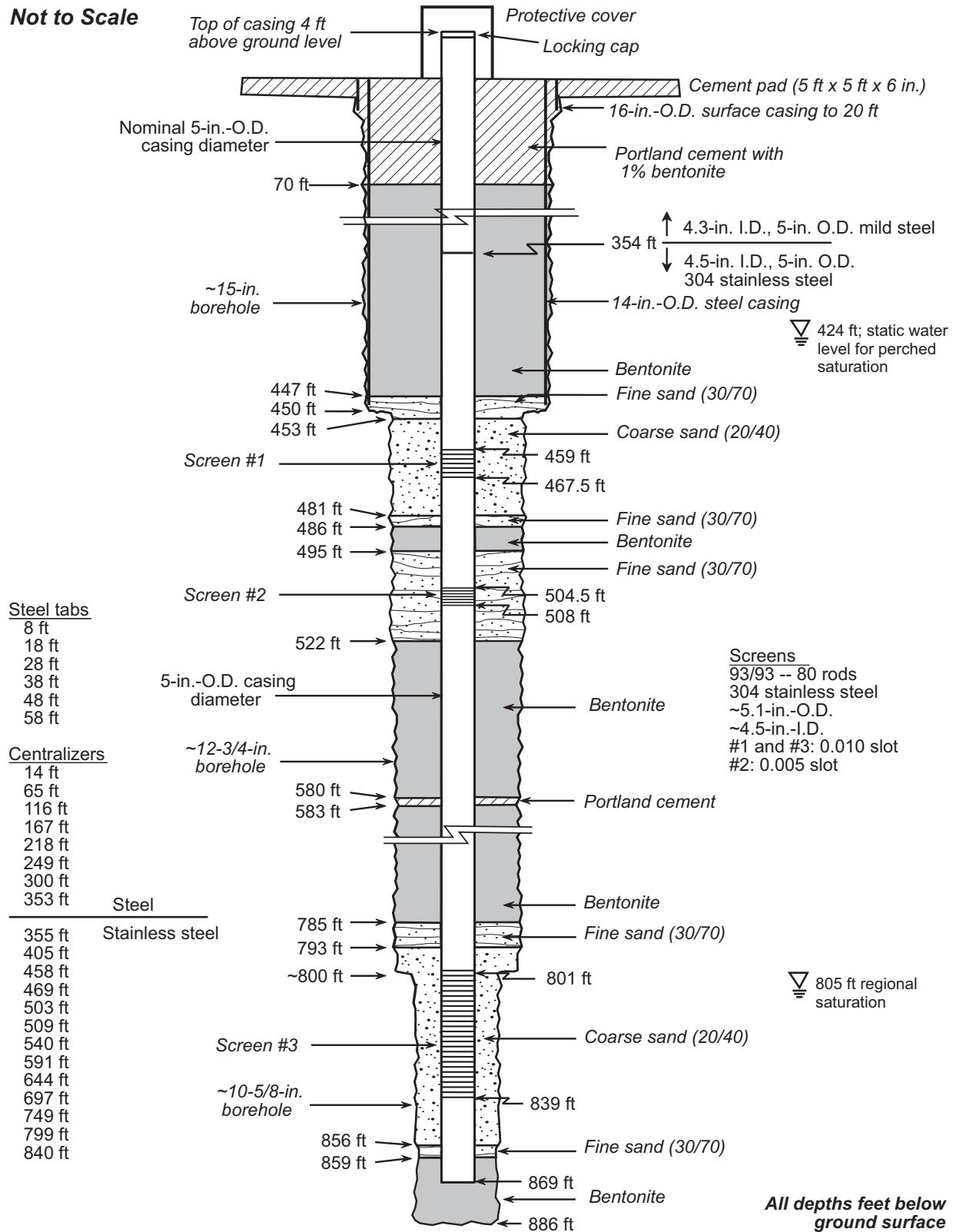
The principal hydrogeologic units penetrated in well R-12, in descending order, consist of alluvium, the Cerro Toledo Interval, Otowi Member of the Bandelier Tuff, late Pliocene soil, basaltic rocks of the Cerros del Rio volcanic field, older alluvium, the Puye Formation, and Santa Fe Group basalt (Broxton et al. 2001, 71252). A thick-perched zone of saturation was found between approximately 424 and 519 ft in the Cerros del Rio basalt (screen #1) and older alluvium (screen #2). Screen #3 is set in the Santa Fe Group basalt. The perching layer within the older alluvium is clay rich (Broxton et al. 2001, 71252). No aquifer performance testing was conducted on well R-12.

4.0 FIELD SAMPLING AND ANALYTICAL METHODS

4.1 Field Sampling Methods

Because of the low-flow (3.8 liters per hour) sampling method used at Westbay®-constructed wells, no casing volumes of groundwater were pumped from well R-12 prior to groundwater sampling events. Field parameters including pH, specific conductance, turbidity, and temperature were recorded during each sampling event. Field alkalinity was measured during the third and fourth sampling events using a portable HACH® instrument (titration).

Groundwater samples analyzed for inorganic and organic chemicals and radionuclides were collected using the Westbay® MP55 system® at well R-12. Temperature, turbidity, pH, alkalinity, and specific conductance were determined on-site from an aliquot collected during field sampling. Both filtered and nonfiltered samples were collected for chemical and radiochemical analyses. Only filtered samples were collected for analyses of isotopic americium, cesium, plutonium, strontium, and uranium during the third and fourth sampling events. Nonfiltered samples were analyzed for gross alpha, gross beta, and gross gamma to provide a worst-case estimate of radioactivity in the groundwater samples. Groundwater samples were collected for analyses of DOC; TOC; stable isotopes of hydrogen, oxygen, and nitrogen; major cations and anions; metals and trace elements; organic compounds; and radionuclides. Aliquots of the samples were filtered through a 0.45-µm Gelman filter and acidified with analytical-grade HNO₃ to a pH of 2.0 or less for metal and radionuclide analyses. DOC samples were filtered with a special 0.45-µm silver filter to eliminate biodegradation of organic solutes. All groundwater samples collected in the field were stored at 4°C until they were analyzed. The first round of groundwater sampling took place approximately eight months after completion of well R-12.



Note: Depths for screens are for actual screen intervals, not joints.

F8.1-2 / R-12 WELL COMPLETION RPT / 082400 / PTM

Figure 2.2-1. As-built well completion diagram of R-12 (Broxton et al. 2001, 71252)

4.2 Field Parameters

Field-measured parameters for the groundwater samples, including pH, temperature, specific conductance, and turbidity, are provided in Tables 4.2-1a, 4.2-1b, and 4.2-1c. These parameters were measured at the time of sample collection when groundwater was in contact with the atmosphere. Temperature, specific conductance, and pH were measured with an Orion meter (model 1230); turbidity was measured with a HACH® meter (model 53600-00). Both meters were calibrated daily using buffer solutions (pH 4 and 7) and known standards for turbidity. Field measurements were recorded with daily activity logs submitted to the ER Project and are included in the analytical results. Turbidity values for these samples are generally less than 5 nephelometric turbidity units ([NTUs] Tables 4.2-1a, 4.2-1b, and 4.2-1c).

Table 4.2-1a
Field-Measured Parameters for Groundwater Samples Collected at Well R-12, Screen #1

Geologic Unit	Cerro del Rio basalt			
Depth (ft)	468.0	468.0	468.0	468.0
Date sampled (mo/d/yr)	09/18/00	03/14/01	06/13/01	09/07/01
pH (standard units)	8.01	6.91	8.63	8.94
Temperature (°C)	21.8	13.2	19.9	21.3
Specific conductance ($\mu\text{S}/\text{cm}^{\text{a}}$)	280	254	175	122
Turbidity (NTU ^b)	3.3	4.4	5.3	6.5

^a $\mu\text{S}/\text{cm}$ = microSiemens per centimeter.

^b NTU = nephelometric turbidity unit.

Table 4.2-1b
Field-Measured Parameters for Groundwater Samples Collected at Well R-12, Screen #2

Geologic Unit	Older alluvium	Older alluvium	Older alluvium	Older alluvium
Depth (ft)	507.0	507.0	507.0	507.0
Date sampled (mo/d/yr)	09/19/00	03/15/01	06/13/01	09/10/01
pH (standard units)	8.62	9.08	8.89	9.26
Temperature (°C)	23.6	17.1	18.0	24.4
Specific conductance ($\mu\text{S}/\text{cm}^{\text{a}}$)	200	155	155	156
Turbidity (NTU ^b)	2.8	2.3	0.9	2.5

^a $\mu\text{S}/\text{cm}$ = microSiemens per centimeter.

^b NTU = nephelometric turbidity unit.

Table 4.2-1c
Field-Measured Parameters for Groundwater Samples Collected at Well R-12, Screen #3

Geologic Unit	Santa Fe Group basalt			
Depth (ft)	811.0	811.0	811.0	811.0
Date sampled (mo/d/yr)	09/20/00	03/16/01	06/14/01	09/12/01
pH (standard units)	7.24	6.83	7.43	7.57
Temperature (°C)	22.5	19.9	22.3	25.8
Specific conductance ($\mu\text{S}/\text{cm}^{\text{a}}$)	300	389	381	388
Turbidity (NTU ^b)	6.8	2.6	5.6	5.0

^a $\mu\text{S}/\text{cm}$ = microSiemens per centimeter.

^b NTU = nephelometric turbidity unit.

Measurements of water temperature recorded on land surface ranged from 13.2 to 24.4°C for groundwater samples collected from the perched system and from 19.9 to 25.8°C for samples collected from the regional aquifer. The lowest temperature measurements were recorded in the winter of 2001. Variations in temperature may be influenced by ambient temperature even though temperature measurements were recorded immediately during sample collection.

4.3 Analytical and Validation Methods

4.3.1 Analytical Methods

Groundwater samples were analyzed using techniques specified in EPA SW-846 methods, including ion chromatography (IC) for bromide, chloride, fluoride, oxalate, nitrate plus nitrite, perchlorate, phosphate, and sulfate. Inductively coupled argon plasma optical emission spectroscopy (ICPOES) was the analytical method used for trace elements (aluminum, arsenic, barium, boron, calcium, chromium, cobalt, copper, iron, magnesium, manganese, molybdenum, nickel, potassium, selenium, silicon [silica], silver, sodium, strontium, vanadium, and zinc). Total cyanide was analyzed by colorimetry (C), and mercury was analyzed by cold vapor atomic absorption (CVAA). Ammonium was analyzed by ion selective electrode (ISE). TKN was measured by distillation at GEL. Antimony, beryllium, cadmium, lead, thallium, and uranium were analyzed by inductively coupled argon plasma mass spectrometry (ICPMS). Uranium was also analyzed by kinetic phosphorimetric analysis (KPA) during several sampling rounds. There was excellent agreement with uranium concentrations between the two methods for analyzing uranium (Appendix A). The analytical work was performed by ER Project-approved subcontractor laboratories, including Paragon Analytics, Inc., (IC, C, ISE, CVAA, KPA, and ICPOES methods) and General Engineering Laboratory (GEL) (IC, C, ISE, CVAA, ICPOES, ICPMS methods and perchlorate-IC). Alkalinity was determined in the Paragon and GEL laboratories using standard titration techniques. Laboratory blanks were analyzed according to EPA and LANL procedures. The precision limits for major ions and trace elements were generally $\pm 10\%$. DOC fractionation was performed using an XAD-8 column at Huffman Laboratories. (Elution of hydrophobic and hydrophilic organic compounds is based on physical adsorption.)

Tritium activity in groundwater was determined by direct counting. Radiometric methods included alpha spectrometry for americium, plutonium, and uranium isotopes; gamma spectrometry for cesium-137 and other gamma-emitting isotopes; and gas proportional counting for strontium-90. These analyses were

performed by contract laboratories, including Severn Trent-Richland Laboratories (radionuclides, fourth sampling round); Paragon Analytics, Inc., (radionuclides, first, second, and third sampling rounds); and the University of Miami (low-level tritium).

Geochron Laboratories (Cambridge, Massachusetts) analyzed stable isotope ratios of oxygen ($\delta^{18}\text{O}$) and hydrogen (δD) using isotope ratio mass spectroscopy (IRMS). Coastal Science Laboratories, Inc., (Austin, Texas) analyzed nitrogen isotope ratios ($\delta^{15}\text{N}_{\text{AIR}}\text{-NO}_3$ and $\delta^{15}\text{N}_{\text{AIR}}\text{-NH}_4$) using IRMS.

Volatile and semivolatile organic compounds, HE compounds, polychlorinated biphenyls, and pesticides were analyzed by high-pressure liquid chromatography and gas chromatography mass spectrometry. Paragon Analytics, Inc., and GEL performed these organic analyses.

4.3.2 Validation Methods

Data quality validation, performed according to ER Project standard operation procedures for routine data validation, was done on chemical and radiochemical analytical results for groundwater samples collected from well R-12. The validation process revealed no deficiencies. Groundwater samples were analyzed within required holding times. Laboratory blanks, percent tracer recovery, laboratory duplicate samples, laboratory control samples, internal standards, spike recovery, and analyte concentrations relative to instrument detection and reporting (quantitation) limits were evaluated as part of the validation procedure. Charge-balance errors for analytical results were calculated for major and trace ions using the computer program MINTEQA2. Percent charge balance is defined as follows:

$$\frac{(100)[(\sum \text{ milliequivalents cations} - \sum \text{ milliequivalents anions}) \text{ divided by}]}{(\sum \text{ milliequivalents cations} + \sum \text{ milliequivalents anions})}]$$

“Detection” of a chemical in groundwater is defined as finding an analyte concentration that exceeds the instrument detection limit (IDL). Detection of a radionuclide in groundwater occurs if its activity exceeds 3σ (three standard deviations) above the instrument MDA. The 3σ values for every radionuclide are contained in the ER Project database and were included as part of data validation. A “nondetect” is defined as an analyte concentration that is recorded but is less than the IDL. The reporting limit (RL) is defined as the instrument quantitation limit.

5.0 GROUNDWATER ANALYTICAL RESULTS

This section presents analytical results obtained during four sampling rounds conducted at well R-12 on September 18 through 20, 2000, on March 14 through 16, 2001, on June 13 through 14, 2001, and on September 7 through 12, 2001. Analyte suites include major ions, trace elements, trace metals, radionuclides, stable isotopes, organic compounds, and DOC. Analytical results show that contaminant concentrations are below MCLs, excluding total and dissolved manganese with an EPA secondary standard of 0.05 mg/L for drinking water and an NMED standard of 0.2 mg/L for domestic water supply, within the perched zone and regional aquifer. Concentrations of manganese are most likely derived from natural sources as a result of the reduction and dissolution of manganese minerals in the presence of residual drilling fluids. Concentrations of total iron are also above the EPA standard of 0.3 mg/L for several sampling events (screens #1 and #3).

5.1 Major Ions, Metals, Radionuclides, Organic Compounds, and Stable Isotopes

Selected results of inorganic and organic analytes measured at well R-12 are provided in Tables 5.1-1, 5.1-2, and 5.1-3, and complete analytical results are provided in Appendix A. Groundwater sampled at well R-12 had speciated charge-balance errors, calculated by MINTEQA2, mostly less than $\pm 10\%$. The positive charge-balance errors in Tables 5.1-1, 5.1-2, and 5.1-3 indicate excess cations from analytical results, a finding that is probably the result of analytical errors within acceptable instrument precision ($< \pm 10\%$) associated with ICPOES at Paragon Analytics, Inc., and GEL. Negative charge-balance errors in Tables 5.1-1, 5.1-2, and 5.1-3 indicate excess anions from analytical results, a finding that probably results from shifts in alkalinity (varying alkalinity) because this parameter is measured off-site at Paragon Analytics, Inc., and GEL.

Table 5.1-1
Hydrochemistry of Selected Analytes for Well R-12, Screen #1, Upper Sandia Canyon

Depth of Measurement Port (ft)	468.0	468.0	468.0	468.0
Geologic Unit	Cerros del Rio basalt	Cerros del Rio basalt	Cerros del Rio basalt	Cerros del Rio basalt
Sample Treatment	Filtered	Filtered	Filtered	Filtered
Date Sampled (mo/d/yr)	09/18/00	03/14/01	06/13/01	09/07/01
Alkalinity (CaCO ₃ mg/L)	170	120	71	53
Ca (mg/L)	30.0	15.0	4.8	3.0
Mg (mg/L)	9.0	4.3	1.2	0.6
Na (mg/L)	26.0	23.0	21.0	25.6
K (mg/L)	4.5	3.3	2.2	1.5
Cl (mg/L)	16.0	13.0	12.0	10.1
SiO ₂ (mg/L)	34.1	41.7	25.7	26.3
SO ₄ (mg/L)	3.60	[1.00], U ^a	[1.00], U	0.30
NH ₄ (as N) (mg/L)	1.10	1.60	3.10	3.12
B (mg/L)	0.096	[0.110], U	0.120	0.122
Ba (mg/L)	0.038	0.048	0.031	0.022
ClO ₄ (mg/L)	[0.00104], U	[0.00096], U	[0.00096], U	[0.00096], U
F (mg/L)	0.52	0.68	0.51	0.56
Fe (mg/L)	[0.16], U	0.60	[0.15], U	0.11
Mn (mg/L)	0.86	0.72	0.20	0.055
Mo (mg/L)	0.021	0.003	0.025	0.022
Ni (mg/L)	0.0051	0.0009	[0.0019], U	0.0023
NO ₃ + NO ₂ (as N) (mg/L)	[0.10], U	0.23	[0.05], U	0.03
Sr (mg/L)	0.130	0.071	0.025	0.014
P (total) (mg/L)	[0.05], U	[0.05], U	0.44	0.44
DOC (mgC/L)	Not analyzed	Not analyzed	Not analyzed	5.0
TOC (mgC/L), NF	7.70	8.90	12.0	10.0
TKN (mg/L)	0.91	2.10	3.30	3.90
U (mg/L)	0.00093	0.00006	0.00003	[0.000003], U

Table 5.1-1 (continued)

Depth of Measurement Port (ft)	468.0	468.0	468.0	468.0
Geologic Unit	Cerro Del Rio Basalt	Cerro del Rio basalt	Cerro del Rio Basalt	Cerro del Rio Basalt
Date Sampled (mo/d/yr)	09/18/00	03/14/01	06/13/01	09/07/01
TDS (mg/L) (calculated)	297	226	146	129
MEQ ^b cations	3.597	2.482	1.538	1.581
MEQ anions	3.951	2.827	1.837	1.424
Charge Balance (%)	+4.68	-6.50	-8.86	+5.20
Am-241 (pCi/L), F ^c	[0.003], U	[0.024], U	[0.032], U	[0.0122], U
Cs-137 (pCi/L), F	Not analyzed	[-0.2], U	[0.2], U	[-0.538], U
Pu-238 (pCi/L), F	[-0.002], U	[-0.01], U	[-0.006], U	[-0.0007], U
Pu-239,240 (pCi/L), F	[0.004], U	[0.001], U	[0], U	[-0.0007], U
Sr-90 (pCi/L), F	[0.178], U	[-0.11], U	[0.1], U	[0.238], U
Tritium (pCi/L), NF ^d	192	189	187	181
Gross alpha (pCi/L), NF	[0.884], U	[0.83], U	[1.28], U	[-0.219], U
Gross beta (pCi/L), NF	6.35	3.84	3.1	3.93
Gross gamma (pCi/L), NF	Not analyzed	315	119	[-87.4], U
U-234 (pCi/L), F	0.399	[0.037], U	0.082	0.023
U-235 (pCi/L), F	[0.0076], U	[-0.001], U	[0.013], U	[0], U
U-238 (pCi/L), F	0.248	[0.024], U	[0.028], U	0.019
δD (‰), NF	-84	-81	-78	-79
δ ¹⁵ N (NH ₄) (‰), NF	+5.6	-0.8	-6.1	-6.2
δ ¹⁵ N (NO ₃) (‰), NF	Insufficient sample volume ^e	Insufficient sample volume	Insufficient sample volume	Insufficient sample volume
δ ¹⁸ O (‰), NF	-11.4	-11.7	-11.4	-11.5

^a U = not detected.^b MEQ = milliequivalents.^c F = filtered.^d NF = nonfiltered.^e Nitrate (N) and ammonium (N) concentrations less than 1 mg/L require a one-gallon sample to measure δ¹⁵N.

Table 5.1-2
Hydrochemistry of Selected Analytes for Well R-12, Screen #2, Upper Sandia Canyon

Depth of Measurement Port (ft)	507.0	507.0	507.0	507.0
Geologic Unit	Older alluvium	Older alluvium	Older alluvium	Older alluvium
Sample Treatment	Filtered	Filtered	Filtered	Filtered
Date Sampled (mo/d/yr)	09/19/00	03/15/01	06/13/01	09/10/01
Alkalinity (CaCO ₃ mg/L)	64	67	63	53
Ca (mg/L)	15.0	15.0	14.0	15.0
Mg (mg/L)	3.0	2.5	2.0	1.98
Na (mg/L)	9.4	9.4	9.0	11.1
K (mg/L)	2.1	2.2	2.1	1.98
Cl (mg/L)	6.70	6.70	5.90	4.38
SiO ₂ (mg/L)	29.8	30.0	32.1	31.0
SO ₄ (mg/L)	7.40	8.10	8.50	7.65
NH ₄ (as N) (mg/L)	[0.50], U ^a	[0.50], U	0.31	0.27
B (mg/L)	[0.038], U	0.037	0.043	[0.037], U
Ba (mg/L)	0.016	0.015	0.011	0.013
ClO ₄ (mg/L)	[0.00104], U	[0.00096], U	[0.00096], U	[0.00096], U
F (mg/L)	0.43	0.49	0.53	0.40
Fe (mg/L)	[0.03], U	[0.05], U	[0.04], U	[0.002], U
Mn (mg/L)	0.180	0.060	0.034	0.043
Mo (mg/L)	0.011	0.012	0.0083	0.007
Ni (mg/L)	[0.002], U	0.0008	[0.0005], U	[0.001], U
NO ₃ + NO ₂ (as N) (mg/L)	0.13	[0.10], U	0.05	0.07
Sr (mg/L)	0.068	0.065	0.061	0.058
P (total) (mg/L)	0.293	0.072	0.067	0.090
DOC (mgC/L)	Not analyzed	Not analyzed	Not analyzed	1.8
TOC (mgC/L), NF ^b	16.0	5.2	2.7	1.8
TKN (mg/L)	0.57	0.69	0.47	0.49
U (mg/L)	0.00046	0.00066	0.00043	0.00014
TDS (mg/L) (calculated)	139	142	138	127
MEQ ^c cations	1.466	1.423	1.333	1.461
MEQ anions	1.689	1.729	1.640	1.377
Charge Balance (%)	-7.04	-9.70	-10.32	+2.97
Am-241 (pCi/L), F ^d	[0.013], U	[0.018], U	[0.009], U	[0.009], U
Cs-137 (pCi/L), F	[1.3], U	[0.1], U	[0.9], U	[0.019], U
Pu-238 (pCi/L), F	[0.006], U	[0], U	[-0.002], U	[0], U
Pu-239,240 (pCi/L), F	[0.017], U	[0.003], U	[0.006], U	[0.002], U
Sr-90 (pCi/L), F	[0.02], U	[-0.15], U	[-1.2], U	[0.27], U
Tritium (pCi/L), NF	96.1	111	97.7	78.2
Gross alpha (pCi/L), NF	[0.8], U	[1.6], U	1.55	0.71
Gross beta (pCi/L), NF	[1.6], U	[2.3], U	1.78	[2.44], U
Gross gamma (pCi/L), NF	469	298	162	[3.04], U
U-234 (pCi/L), F	0.363	0.3	0.292	0.169
U-235 (pCi/L), F	[0.06], U	[0.03], U	[0.019], U	[0.008], U
U-238 (pCi/L), F	0.225	0.29	0.192	0.097

Table 5.1-2 (continued)

Depth of Measurement Port (ft)	507.0	507.0	507.0	507.0
Geologic Unit	Older alluvium	Older alluvium	Older alluvium	Older alluvium
Date Sampled (mo/d/yr)	09/19/00	03/15/01	06/13/01	09/10/01
δD (‰), NF	-85	-80	-78	-82
$\delta^{15}\text{N}$ (NH_4) (‰), NF	Insufficient sample volume ^e	Insufficient sample volume	Insufficient sample volume	Insufficient sample volume
$\delta^{15}\text{N}$ (NO_3) (‰), NF	-3.7	+1.5	Insufficient sample volume	+10.2
$\delta^{18}\text{O}$ (‰), NF	-11.5	-11.6	-11.5	-11.5

^a U = not detected^b NF = nonfiltered.^c MEQ = milliequivalents.^d F= filtered.^e Nitrate (N) and ammonium (N) concentrations less than 1 mg/L require a one-gallon sample to measure $\delta^{15}\text{N}$.

Table 5.1-3
Hydrochemistry of Selected Analytes for Well R-12, Screen #3, Upper Sandia Canyon

Depth of Measurement Port (ft)	811.0	811.0	811.0	811.0
Geologic Unit	Santa Fe Group basalt			
Sample Treatment	Filtered	Filtered	Filtered	Filtered
Date Sampled (mo/d/yr)	09/20/00	03/16/01	06/14/01	09/11/01
Alkalinity (CaCO_3 mg/L)	170	180	179	171
Ca (mg/L)	41.0	43.0	46.0	44.0
Mg (mg/L)	9.9	10.0	11.0	10.4
Na (mg/L)	18.0	17.0	17.0	18.3
K (mg/L)	4.4	4.6	4.6	4.3
Cl (mg/L)	10.0	9.30	9.30	8.81
SiO_2 (mg/L)	55.4	59.9	59.9	57.8
SO_4 (mg/L)	16.0	11.0	10.0	13.4
NH_4 (mg/L)	[0.50], U ^a	[0.50], U	[0.10], U	Not analyzed
B (mg/L)	0.110	0.084	0.068	[0.073], U
Ba (mg/L)	0.110	0.140	0.140	0.145
ClO_4 (mg/L)	[0.00104], U	[0.00096], U	[0.00096], U	Not analyzed
F (mg/L)	0.27	0.32	0.47	0.37
Fe (mg/L)	0.74	0.27	[0.09], U	[0.002], U
Mn (mg/L)	1.10	0.66	0.55	0.34

Table 5.1-3 (continued)

Depth of Measurement Port (ft)	811.0	811.0	811.0	811.0
Geologic Unit	Santa Fe Group basalt	Santa Fe Group basalt	Santa Fe Group basalt	Santa Fe Group basalt
Date Sampled (mo/d/yr)	09/20/00	03/16/01	06/14/01	09/12/01
Mo (mg/L)	0.0083	0.0063	0.0039	0.0059
Ni (mg/L)	0.049	0.011	0.0098	0.0048
NO ₃ + NO ₂ (as N) (mg/L)	[0.10], U	[0.10], U	[0.05], U	0.01
Sr (mg/L)	0.210	0.230	0.230	0.231
P (total) (mg/L)	[0.05], U	[0.05], U	[0.05], U	0.05
DOC (mgC/L)	Not analyzed	Not analyzed	Not analyzed	1.1
TOC (mgC/L), NF ^b	45.0	5.1	Not analyzed	0.35
TKN (mg/L)	0.25	0.28	0.40	0.30
U (mg/L)	0.00033	0.00125	0.00195	0.00194
TDS (mg/L) (calculated)	328	337	339	329
MEQ ^c cations	3.831	3.868	4.086	3.978
MEQ anions	4.027	4.106	4.073	3.970
Charge Balance (%)	-2.48	-2.98	+0.16	+0.11
Am-241 (pCi/L), F ^d	[0.012], U	[-0.002], U	[0.005], U	[0.007], U
Cs-137 (pCi/L), F	[-0.7], U	[-1.4], U	[-1.4], U	[2.19], U
Pu-238 (pCi/L), F	[0.033], U	[0], U	[0.005], U	[0.002], U
Pu-239,240 (pCi/L), F	[0.006], U	[0.005], U	[0.007], U	[0.005], U
Sr-90 (pCi/L), F	[0.25], U	[-0.03], U	[-0.6], U	[0.165], U
Tritium (pCi/L), NF	82.7	63.9	57.1	49.8
Gross alpha (pCi/L), NF	[1.2], U	[1.3], U	[1.2], U	2.21
Gross beta (pCi/L), NF	4.9	4.1	3.9	5.98
Gross gamma (pCi/L), NF	[346], U	297	153	[1.91], U
U-234 (pCi/L), F	0.236	0.73	1.2	1.33
U-235 (pCi/L), F	[0.055], U	[0.063], U	[0.052], U	[12.6], U
U-238 (pCi/L), F	0.108	0.43	0.67	0.7
δD (‰), NF	-81	-76	-74	-74
δ ¹⁵ N (NH ₄) (‰), NF	Insufficient sample volume ^e	Insufficient sample volume	Insufficient sample volume	Insufficient sample volume
δ ¹⁵ N (NO ₃) (‰), NF	Insufficient sample volume	Insufficient sample volume	Insufficient sample volume	Insufficient sample volume
δ ¹⁸ O (‰), NF	-11.3	-11.1	-10.8	-10.8

^aU = not detected.^bNF = nonfiltered.^cMEQ = milliequivalents.^dF= filtered.^eNitrate (N) and ammonium (N) concentrations less than 1 mg/L require a one-gallon sample to measure δ¹⁵N.

Several analytes including DOC, gross gamma, cesium-137, and ammonium were not analyzed during some of the sampling events because of the limitation of sample volume collected from screens #1, #2, and #3. In addition, nonroutine parameters (DOC) were not needed on a quarterly basis. Analysis of $\delta^{15}\text{N-NO}_3$ and $\delta^{15}\text{N-NH}_4$ requires a one-gallon sample if NO_3 (as N) and NH_4 (as N) concentrations are less than one mg/L. Consequently, one-liter samples were collected for stable isotope analyses of nitrogen.

Figures 5.1-1 through 5.1-3 show the distribution of major ions within the perched zone and regional aquifer at well R-12. Groundwater samples were collected from the perched zone at depths of 468.0 ft (screen #1) and 507.0 ft (screen #2) and from the regional aquifer at a depth of 811.0 ft (screen #3). Perched groundwater at well R-12 ranges from a calcium-sodium-bicarbonate to a sodium-calcium-bicarbonate ionic composition (Figures 5.1-1 and 5.1-2). Groundwater within the regional aquifer is characterized by a calcium-sodium-bicarbonate ionic composition (Figure 5.1-3).

Calculated total dissolved solids (TDS) ranged between 127 and 297 mg/L within the perched zone (Tables 5.1-1 and 5.1-2) and from 328 to 339 mg/L in the regional aquifer (Table 5.1-3). Groundwater samples collected from 468.0 ft showed a strong decrease in TDS mainly because of decreasing alkalinity and calcium and other cation concentrations (Figure 5.1-1). This finding suggests that sampled groundwater collected from screen #1 is reequilibrating and is approaching the chemical composition of native or predrilling groundwater at well R-12. Average concentrations of dissolved chloride, fluoride, nitrate plus nitrite (as N), and sulfate were 9.35, 0.51, 0.09, and 5.97 mg/L, respectively, within the perched zone at depths of 468.0 and 507.0 ft (Tables 5.1-1 and 5.1-2). Figures 5.1-4 and 5.1-5 show time versus solute concentrations of sulfate, ammonium (as N), iron, manganese, nitrate plus nitrite (as N), TOC, TKN, and total phosphorus for groundwater samples collected from depths of 468 and 507 ft, respectively. Concentrations of sulfate were less than detection (1.0 mg/L) for two of the four groundwater samples collected in the perched zone at a depth of 468.0 ft (Table 5.1-1, Figure 5.1-4).

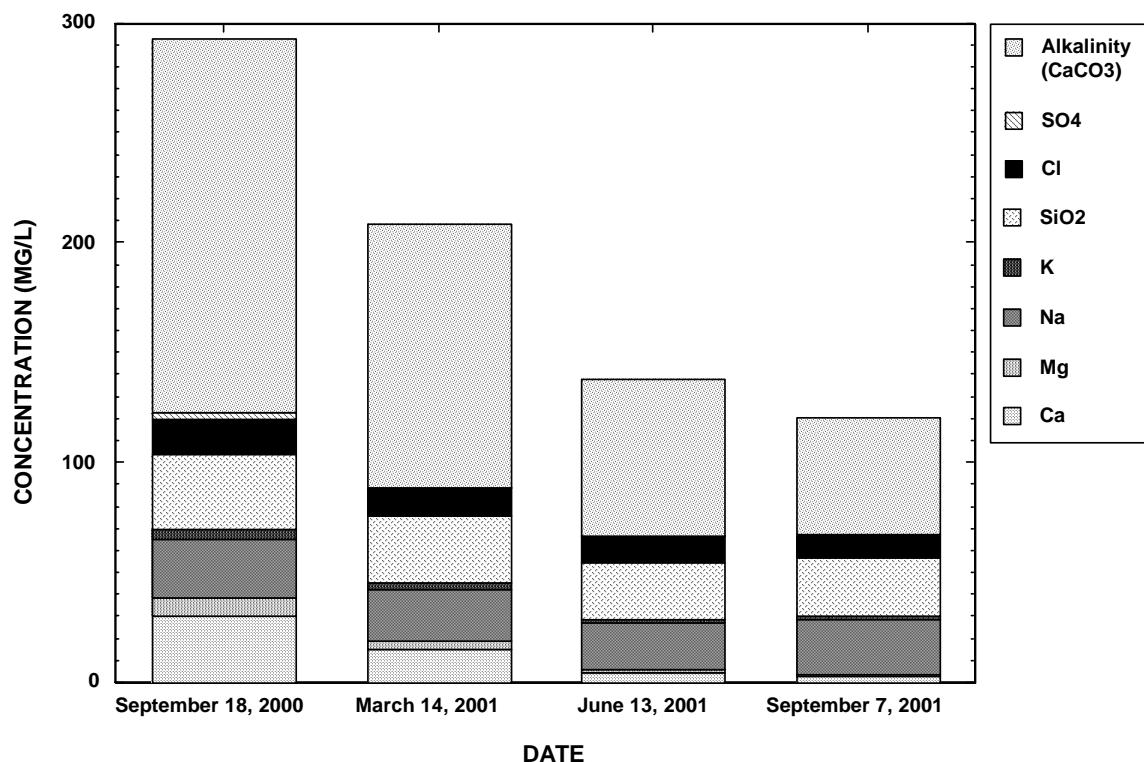


Figure 5.1-1. Major ion chemistry for well R-12 (perched zone, 468.0 ft), upper Sandia Canyon

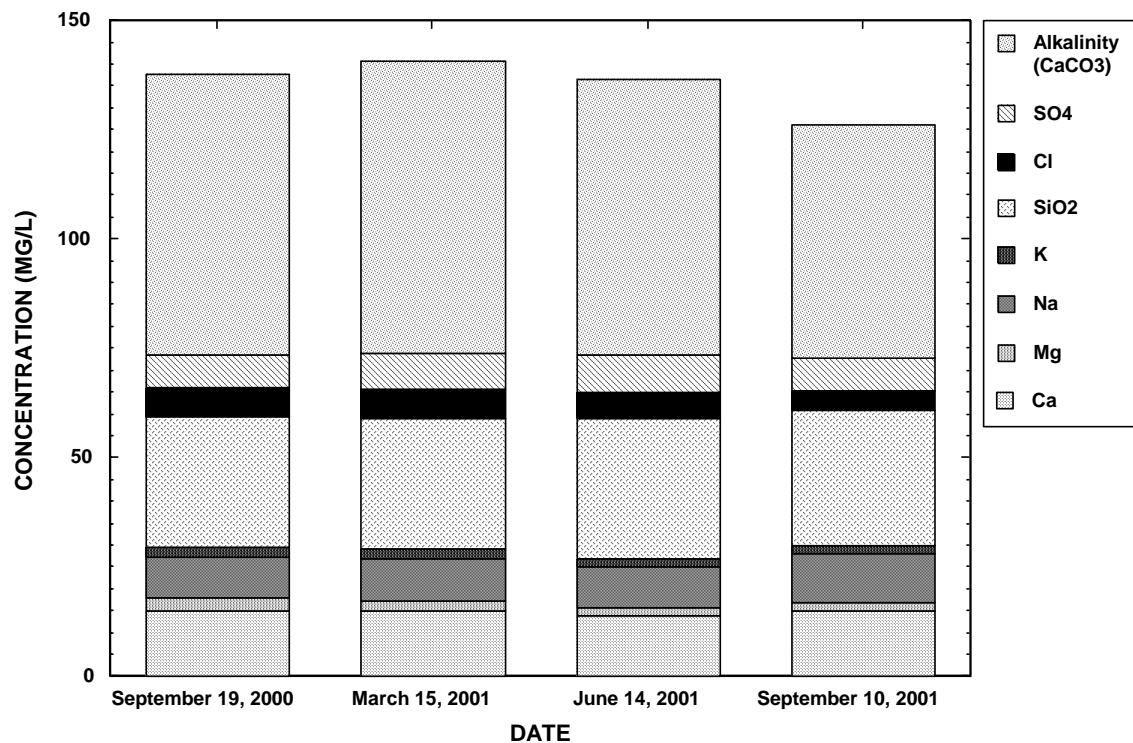


Figure 5.1-2. Major ion chemistry for well R-12 (perched zone, 507.0 ft), upper Sandia Canyon

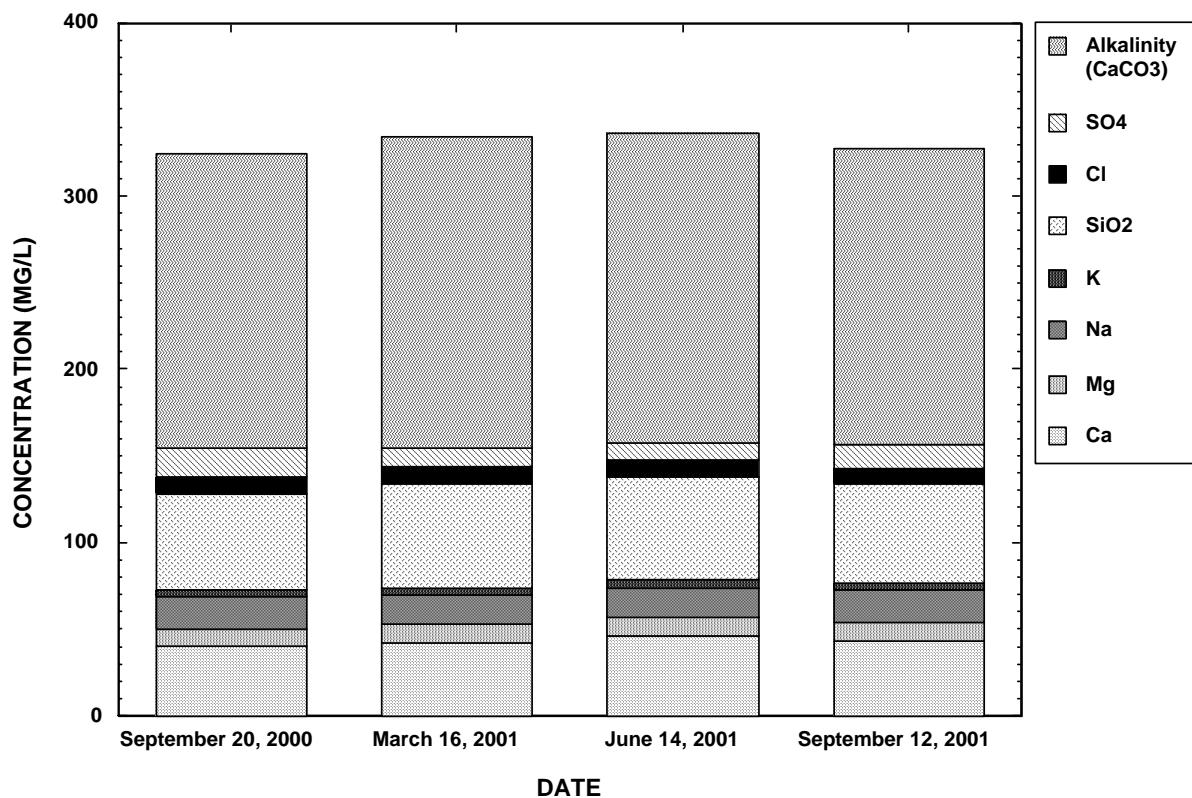
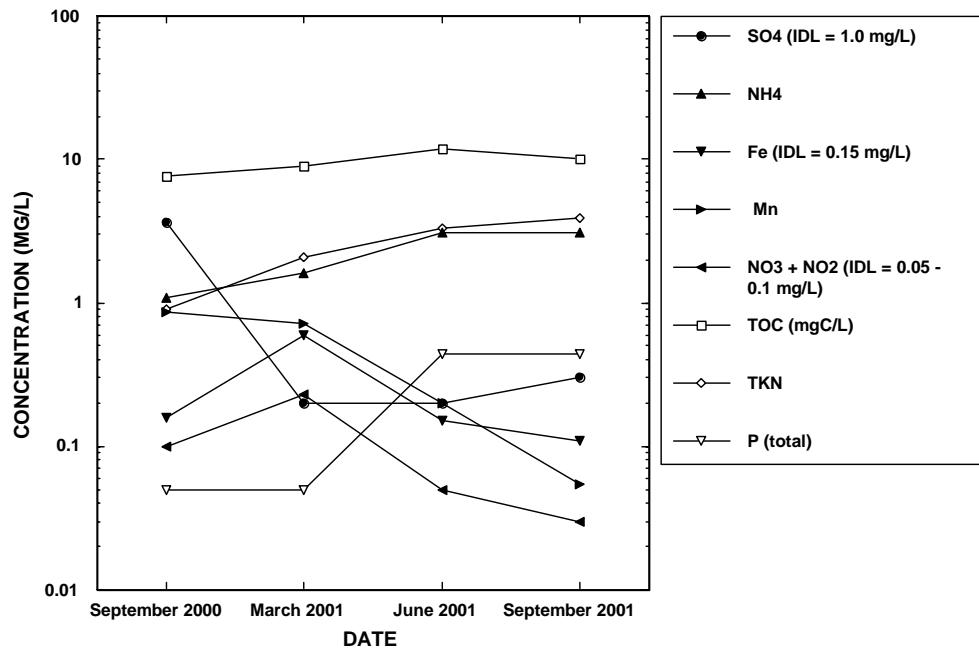
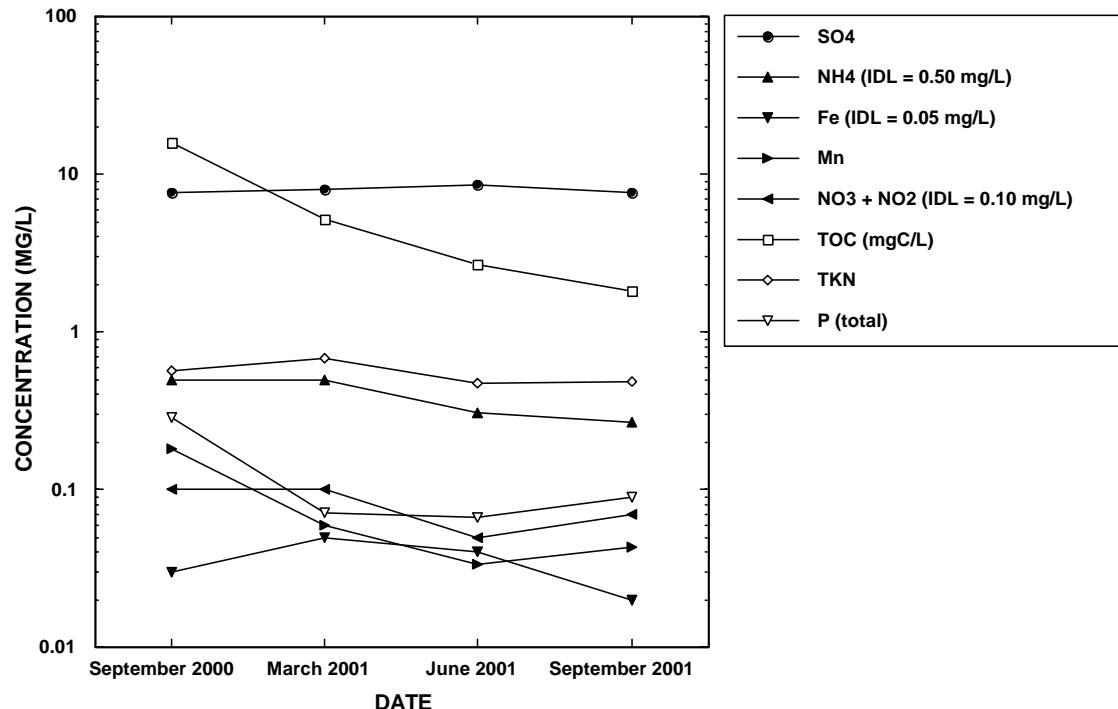


Figure 5.1-3. Major ion chemistry for well R-12 (regional aquifer, 811.0 ft), upper Sandia Canyon



IDL = instrument detection limit

Figure 5.1-4. Distributions of sulfate, ammonium, iron, manganese, nitrate plus nitrite, total organic carbon, total Kjeldahl nitrogen, and phosphorus in well R-12, perched zone (468.0 ft), upper Sandia Canyon



IDL = instrument detection limit

Figure 5.1-5. Distributions of sulfate, ammonium, iron, manganese, nitrate plus nitrite, total organic carbon, total Kjeldahl nitrogen, and phosphorus in well R-12, perched zone (507.0 ft), upper Sandia Canyon

The aqueous chemistry of the perched zone varies between 468.0 and 507.0 ft with respect to major ions, dissolved silica, and selected trace solutes ([ammonium, strontium, TKN, barium, and boron] Tables 5.1-1 and 5.1.2). Chemical gradients consisting of decreasing sodium and chloride concentrations and tritium activities were most pronounced with depth within the perched zone. During drilling of well R-12, continuous saturation was encountered in the perched zone from 424 to 519 ft, suggesting a single zone of saturation (Broxton et al. 2001, 71252).

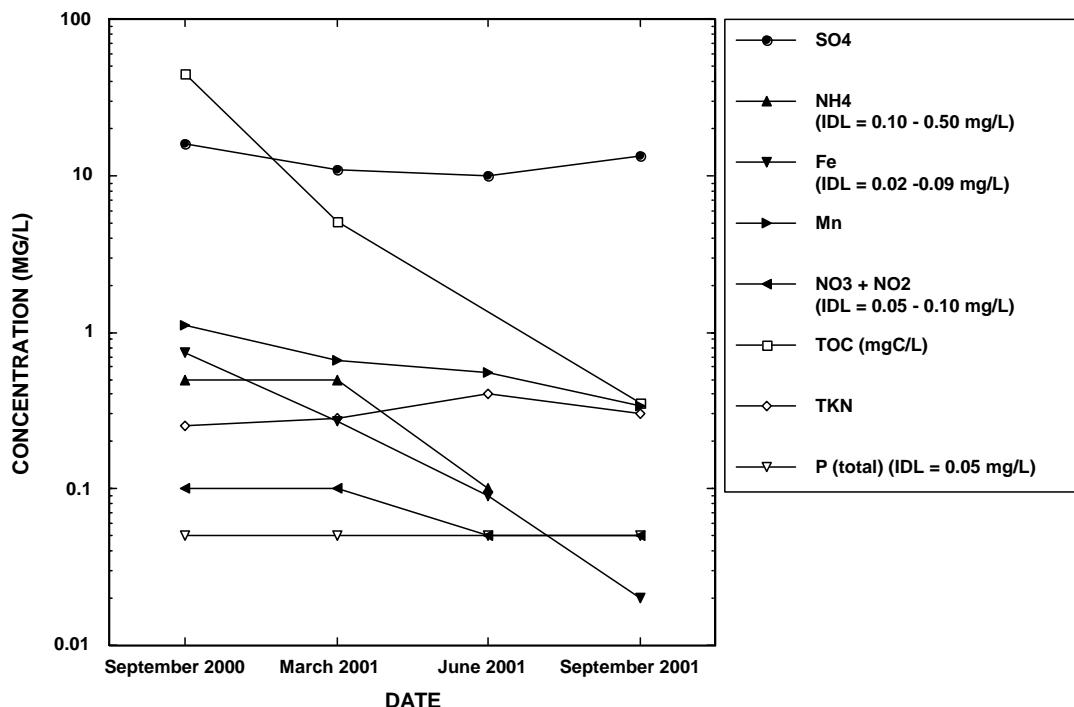
Reduction of sulfate (electron acceptor) occurs during oxidation of organic carbon (electron donor) present in EZ-MUD® and other residual drilling fluids, based on decreasing concentrations of sulfate and increasing concentrations of phosphorus, ammonium, and TKN. Sulfide odor was detected in groundwater samples collected from 468.0 ft during the third sampling event. A slight increase in concentration of sulfate (0.30 mg/L), however, was observed at 468.0 ft during the fourth sampling event (Figure 5.1-4), suggesting gradual oxidation of reduced sulfur species back to sulfate.

Concentrations of both ammonium (as N) and TKN were similar and generally increased over time in the perched zone at 468.0 ft (Figure 5.1-4), which suggests that EZ-MUD® is dissociating, as shown by elevated concentrations of TOC (Figure 5.1-4). TKN was detected in the perched zone at concentrations ranging from 0.47 to 3.9 mg/L. Concentrations of detectable ammonium (as N) ranged from 0.27 to 3.12 mg/L within the perched zone (Tables 5.1-1 and 5.1-2, Figures 5.1-4 and 5.1-5). Concentrations of nitrate plus nitrite (as N) varied with time in groundwater samples collected from the perched zone (Figures 5.1-4 and 5.1-5). Concentrations of TKN and ammonium (as N) in groundwater samples collected from screen #2 were less than those measured at screen #1 (Figure 5.1-4 and 5.1-5). Concentrations of total phosphorus increased during the second and third sampling events for screen #1, which suggests that EZ-MUD® and other residual drilling fluids were breaking down to form smaller molecules and releasing phosphate to groundwater (Figure 5.1-4).

Within the regional aquifer, at a depth of 811.0 ft, the average concentrations of dissolved chloride, fluoride, nitrate plus nitrite (as N), and sulfate are 9.35, 0.36, 0.01 (single detected value), and 12.6 mg/L, respectively. Concentrations of alkalinity varied over time, probably resulting from continued oxidation of residual drilling fluid (EZ-MUD®). Nitrate is stable under oxidizing conditions and can be reduced to nitrogen gas in the presence of denitrifying bacteria and electron donors such as reduced manganese [Mn(II)] and iron [Fe(II)] and DOC (Langmuir 1997, 56037). Nitrate and nitrite are stable as anions and are generally conservative (mobile) in aqueous systems under oxidizing conditions (Langmuir 1997, 56037).

Field alkalinity measured on June 14 and September 12, 2001, for groundwater samples collected from the regional aquifer (Appendix A) are suspect (91 CaCO₃/L). Measured alkalinity values were 54% and 51% of those measured on September 20, 2000, and March 16, 2001, respectively, resulting in charge-balance errors of positive 25% and 27% for the two sampling events. Carbonate alkalinity has been recalculated using the charge balance equation presented in section 4.3.2 for the last two sampling events for the regional aquifer (Table 5.1-3). This calculation is based on the fact that milliequivalents of cations and anions in water are equal to each other because water is electrically neutral. This calculation also assumes that analyses of the other major ions are accurate with analytical errors less than ±10%. Elevated alkalinity observed at well R-12 consisted of both natural and additional alkalinity, which results from oxidation of residual drilling fluids.

Figure 5.1-6 shows time versus solute concentrations of sulfate, ammonium, iron, manganese, nitrate plus nitrite, TOC, TKN, and total phosphorus for groundwater samples collected from the regional aquifer at a depth of 811.0 ft. Concentrations of dissolved ammonium (as N) and nitrate plus nitrite (as N) were less than detection in the regional aquifer at well R-12 (Table 5.1-3, Figure 5.1-6).



IDL = instrument detection limit

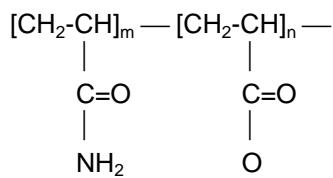
Figure 5.1-6. Distributions of sulfate, ammonium, iron, manganese, nitrate plus nitrite, total organic carbon, total Kjeldahl nitrogen, and phosphorus in well R-12, regional aquifer (811.0 ft), upper Sandia Canyon

Concentrations of dissolved TKN were detected at lower concentrations in the regional aquifer, ranging from 0.25 to 0.30 mg/L (Table 5.1-3 and Figure 5.1-6), as compared to the perched zone (Tables 5.1-1 and 5.1-2 and Figures 5.1-4 and 5.1-5). TKN represents complex forms of organic nitrogen that are associated with EZ-MUD®. Ammonium is less mobile in groundwater relative to nitrate and nitrite because of cation exchange.

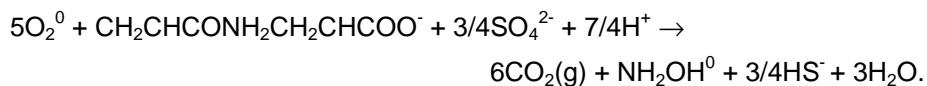
According to the analytical results provided in Tables 5.1-1 through 5.1-3, residual drilling fluid (EZ-MUD®) present in well R-12 influenced the water chemistry by providing organic carbon and nitrogen, which affected the oxidation-reduction chemistry of groundwater adjacent to the well screens. Therefore, it is important to discuss the degradation of the drilling fluids. Elevated concentrations of iron, manganese, TKN, and TOC and decreasing concentration of sulfate are observed in groundwater samples collected from well R-12. Oxidation of residual drilling fluids results in reductive dissolution of ferric (oxy)hydroxide and manganese dioxide that are naturally obscuring.

Oxidation reactions are driven by microbial populations, which obtain energy necessary for respiration (production of carbon dioxide gas and water). Dissolved oxygen is first reduced to water (highest energy yield), which is then followed by successive reduction of N(V) to N(0), Mn(IV) to Mn(III), Mn(III) to Mn(II), Fe(III) to Fe(II), and S(VI) to S(-II) (lowest energy yield) (Langmuir 1997, 56037). All of the above reduction pairs or couples were observed at well R-12 based on analytical results for groundwater samples.

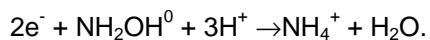
The most logical source of ammonium and TKN is from dissociation (breakdown) of EZ-MUD® consisting of a polycrylamide and polyacrylate copolymer. A generalized structural formula for EZ-MUD® (unit molecule) is represented as follows (Baroid 2001):



The EZ-MUD® copolymer has a molecular weight ranging between 4 and 6 million atomic mass units (amu) and is about 30% anionic, which enhances lubricity and borehole stability by providing adhesion to the borehole wall during drilling. Ammonium and TKN in groundwater at well R-12 result from the dissociation of the polyamide functional groups present in EZ-MUD®. A generalized reaction is presented below:



According to this reaction, dissolved oxygen and sulfate serve as electron acceptors under aerobic and anaerobic conditions, respectively, and EZ-MUD® is the electron donor. This reaction depicts complete oxidation of the hydrocarbon component of the copolymer to form carbon dioxide gas and water. Residual TOC and DOC in the low mg/L range occur in groundwater at well R-12 in the forms of aliphatic hydrocarbons and small molecular weight organic acids (Appendix A), suggesting that EZ-MUD® has not completely oxidized to carbon dioxide gas and water. Dissolved oxygen is the electron acceptor providing the highest energy yield under aerobic conditions and becomes reduced to water prior to the reduction of sulfate. Decreasing concentrations of sulfate were observed in the perched zone (468.0 ft) during two sampling events conducted at well R-12, suggesting that anaerobic conditions were temporarily established. Protons (H^+) are consumed during oxidation of EZ-MUD® and, therefore, the pH is expected to increase, as was generally observed in the perched zone (Tables 5.1-1 and 5.1-2). Six moles of carbon dioxide gas contribute to alkalinity, resulting in increasing concentrations of bicarbonate under circumneutral pH conditions. Hydroxylamine (NH_2OH^0) released from the breakdown of EZ-MUD® reduces to form ammonium according to the following half reaction:



According to this reaction, nitrogen(-I) in hydroxylamine reduces to nitrogen(-III) in ammonium. Dissolved organic carbon, in the form of low molecular weight acids and aliphatic hydrocarbons, is available as an electron donor that enhances the reduction of hydroxylamine to ammonium.

Elevated TOC values measured during the four sampling events at well R-12 indicate the presence of residual drilling fluid (EZ-MUD®) within the perched zone. Groundwater samples collected from a depth of 468.0 ft at well R-12 showed an average TOC concentration of 9.6 mgC/L (range of 7.70 to 12.0 mgC/L) (Table 5.1-1). Groundwater samples collected from a depth of 507.0 ft showed an average TOC concentration of 6.4 mgC/L (range of 1.8 to 16.0 mgC/L) (Table 5.1-2). During the first sampling event at well R-12, 45 mgC/L TOC was measured in a groundwater sample collected from the regional aquifer at a depth of 811.0 ft (Table 5.1-3). Concentrations of TOC significantly decreased during characterization sampling of the regional aquifer at well R-12, indicating that EZ-MUD is oxidizing to inorganic carbon.

Because of the reactions discussed above, perched groundwater at well R-12 at a depth of 468.0 ft is temporally reducing with respect to nitrogen. Ammonium [N(-III)] and TKN are the stable species. More intense reducing conditions were established at this depth shortly after sulfate reduction took place (Table

5.1-1, Figure 5.1-4) during the second and third sampling events. Perched groundwater at a depth of 507.0 ft, however, is relatively oxidizing with respect to sulfur (sulfate) and iron (less than detection), and concentrations of ammonium and TKN are less than 1 mg/L (Table 5.1-2, Figure 5.1-5). Concentrations of TOC in groundwater samples collected from a depth of 507.0 ft (Figure 5.1-5) decreased during the characterization sampling, indicating that over time perched groundwater is becoming more oxidizing with respect to carbon.

A TOC concentration of 45 mgC/L (Table 5.1-3, Figure 5.1-6) was measured in the regional aquifer at a depth of 811.0 ft during the first sampling event. The highest concentrations of dissolved iron (0.74 mg/L) and manganese (1.10 mg/L) were also measured during the first sampling event, suggesting that the regional aquifer was chemically reducing with respect to manganese and iron. Concentrations of TOC strongly decreased in the regional aquifer during characterization sampling, suggesting that groundwater is reequilibrating at well R-12. Concentrations of iron and manganese also decreased within the regional aquifer, suggesting that oxidizing conditions are reestablishing.

Dissolved silica in the form of $\text{Si}(\text{OH})_4^0$ was the second most abundant solute in both the perched zone and the Santa Fe Group basalt at well R-12 (Broxton et al. 2001, 71252). Concentrations of dissolved silica ranged from 25.7 to 34.1 mg/L and from 55.4 to 59.9 mg/L within the perched zone and the regional aquifer, respectively.

Concentrations of perchlorate at well R-12 were less than detection (Tables 5.1-1 through 5.1-3). The MDL for the IC analysis of perchlorate was reported to be 0.001 mg/L by the subcontractor laboratory. The MDL is determined using standard solutions prepared in an ultrapure water matrix, and GEL set a RL of 0.004 mg/L. For the method to reflect the effects of real groundwater matrices, which often contain interfering anions, the subcontractor laboratory provided revised RL and MDL values for perchlorate, as determined by the IC method: they were 0.004 and 0.012 mg/L, respectively.

Concentrations of dissolved iron were generally less than detection in the perched zone (Tables 5.1-1 and 5.1-2), a fact suggesting that perched groundwater is generally oxidizing with respect to iron.

Concentrations of total (nonfiltered) iron detected within the perched zone and the regional aquifer range from 0.52 to 1.40 mg/L and 0.37 to 1.10 mg/L (Appendix A), respectively, suggesting the presence of suspended material, possibly as clay minerals and ferric oxyhydroxide. Concentrations of total iron at well R-12 exceeded the EPA secondary standard of 0.3 mg/L for drinking water (ESP 2000, 68661; ESP 2002, 71301) for several sampling rounds within the perched zone and regional aquifer. Concentration differences between total and dissolved iron exceeded those differences for total and dissolved manganese at well R-12. This finding suggests that manganese(II) is stable as Mn^{2+} , whereas both iron(III) and iron(II) occur in the forms of iron phases that coat suspended material and of solutes, respectively. The Cerros del Rio and Santa Fe Group basalts are likely sources of iron-rich suspended materials. Concentrations of manganese at well R-12 exceeded both the EPA secondary standard of 0.05 mg/L and the NMWQCC secondary standard of 0.2 mg/L for domestic water supply for several sampling rounds.

Concentrations of trace elements, including antimony (Sb), arsenic (As), Ba (barium), beryllium (Be), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), lead (Pb), Mercury (Hg), molybdenum (Mo), nickel (Ni), selenium (Se), silver (Ag), strontium (Sr), thallium (Tl), uranium (U), vanadium (V), and zinc (Zn) were within the low-to-moderate $\mu\text{g}/\text{L}$ range and were less than their respective MCLs in well R-12.

Figure 5.1-7 shows distributions of tritium within the perched zone and regional aquifer at well R-12. Activities of tritium generally decreased in groundwater during characterization sampling. Activities of tritium measured in groundwater samples collected from screen #1 (468.0 ft) averaged 187 pCi/L and varied from 181 to 192 pCi/L (Table 5.1-1). Groundwater samples collected from screen #2 (507.0 ft)

showed an average tritium activity of 95.7 pCi/L, ranging from 78.2 to 111 pCi/L (Table 5.1-2). Activities of tritium measured in groundwater samples collected from the regional aquifer averaged 63.4 pCi/L and varied from 49.8 to 82.7 pCi/L (Table 5.1-3). During drilling of borehole R-12, activities of tritium were 255, 208, 249, and 46.9 pCi/L at depths of 443, 464, 495, and 805 ft. (Broxton et al. 2001, 71252). These tritium activities were higher than those observed during characterization sampling at well R-12. Activities of tritium strongly suggest that some of the sampled groundwater is less than 60 years old and postdates the beginning of nuclear testing.

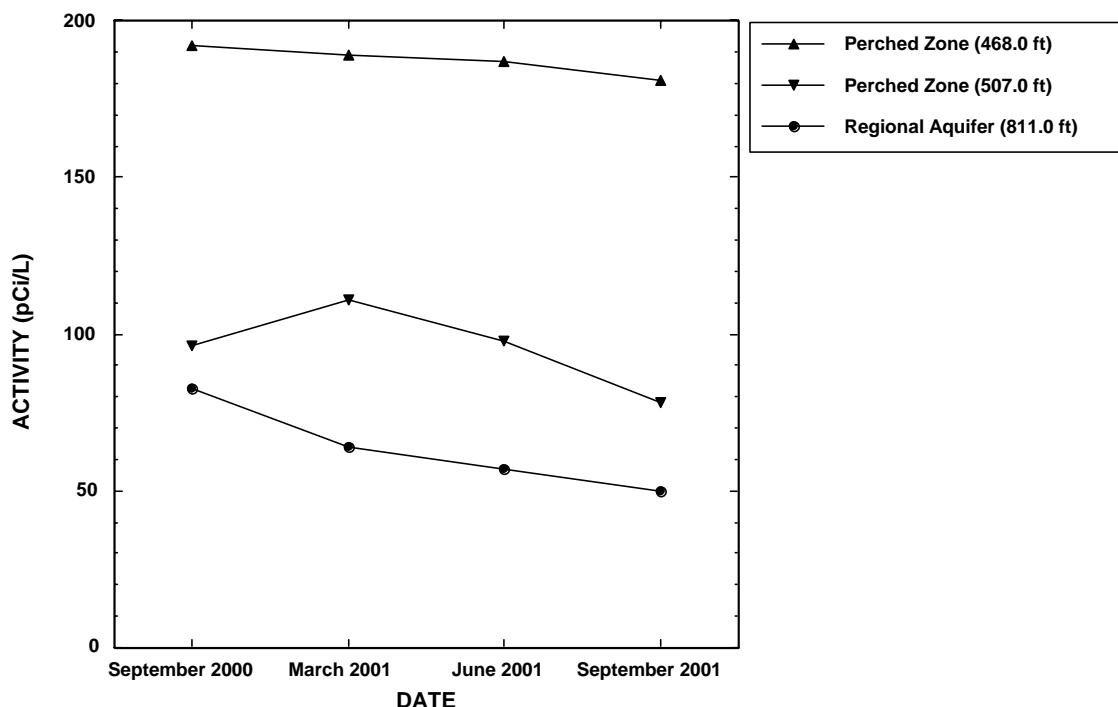


Figure 5.1-7. Distribution of tritium in well R-12, upper Sandia Canyon

Activities of selected radionuclides measured at well R-12 are provided in Tables 5.1-1, 5.1-2, and 5.1-3, and Appendix A. Americium-241, cesium-137, plutonium-238, plutonium-239,240, and strontium-90 were not detected in the groundwater samples collected from well R-12. Based on sediment data reported by LANL (ESP 2000, 68661; ESP 2002, 71301), these radionuclides, if present, adsorb onto aquifer material and migrate in groundwater to a limited extent beneath the alluvium in upper Sandia Canyon. Gross alpha and gross beta activities were generally less than 7 pCi/L in nonfiltered samples (Tables 5.1-1, 5.1-2, and 5.1-3). Measurable gross gamma (119 to 469 pCi/L) was attributed to isotopes within the natural uranium-238, uranium-235, and thorium-232 decay chains (Langmuir 1997, 56037) (Tables 5.1-1, 5.1-2, and 5.1-3). Activities of uranium-238, uranium-235, and uranium-234 were less than 1.5 pCi/L in groundwater samples collected from R-12 (Tables 5.1-1, 5.1-2, and 5.1-3).

Analyses of $\delta^{18}\text{O}$ and δD were performed on groundwater samples collected from well R-12 (Tables 5.1-1, 5.1-2, and 5.1-3), and the results are shown in Figure 5.1-8. The Jemez Mountains meteoric line (upper) and the worldwide meteoric water line (lower) are denoted by JMML and MWL, respectively, in Figure 5.1-8. Results of stable isotope analyses for well R-12 indicate a meteoric source in which the groundwater samples generally plot close (within analytical uncertainty) to both the JMML and MWL (Figure 5.1-8). Analytical uncertainties of $\delta^{18}\text{O}$ and δD are ± 0.1 and $\pm 1\%$, respectively. The distribution of isotopic ratios suggests that evaporation of well R-12 groundwater has not taken place to a significant

extent. The regional aquifer is generally heavier in $\delta^{18}\text{O}$ and δD (enrichment of oxygen-18 and deuterium) as compared to perched groundwater at well R-12, which indicates different sources of recharge for both the perched zone and regional aquifer. Groundwater samples collected from the perched zone were characterized by lighter $\delta^{18}\text{O}$ and δD ratios (depletion of oxygen-18 and deuterium), which suggests that the source of recharge to the perched zone occurs at a higher elevation relative to that of the regional aquifer. Precipitation of meteoric water at higher elevations, for example near the Sierra de Los Valles and Pajarito Plateau, is characterized by cooler temperatures relative to other waters found at lower elevations within the Rio Grande valley. Seasonal variations in temperature also influence $\delta^{18}\text{O}$ and δD values because of enrichment or depletion of oxygen-18 and deuterium.

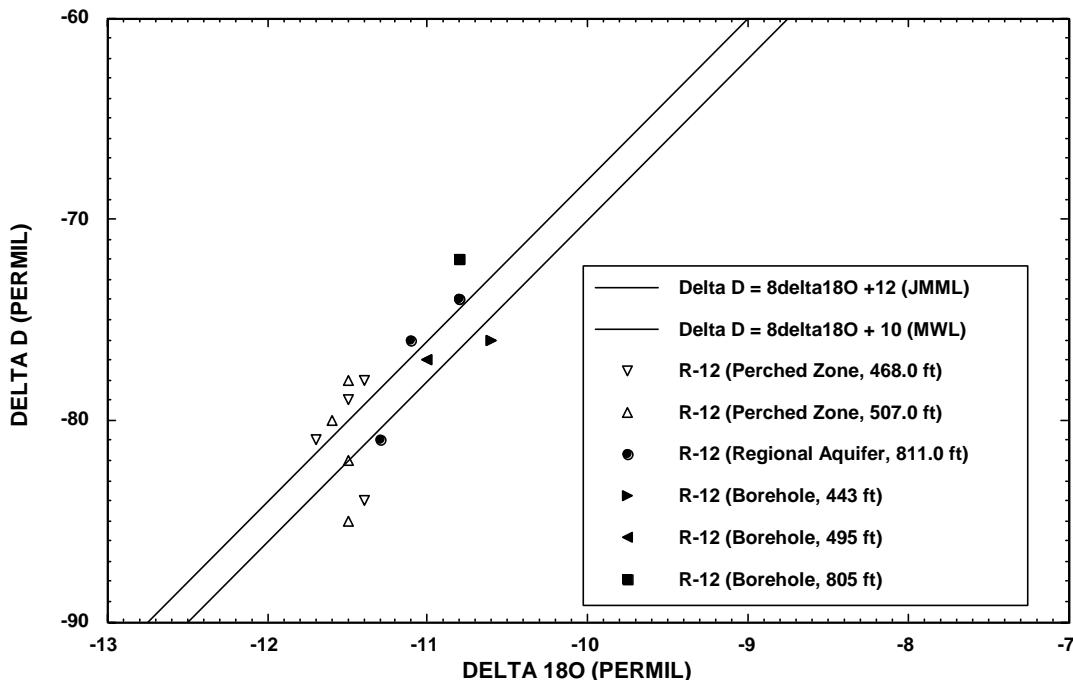


Figure 5.1-8. Stable isotope results for well R-12, upper Sandia Canyon. The upper line is the JMMI, and the lower line is the MWL.

An initial shift to heavier $\delta^{18}\text{O}$ and δD ratios was observed for the borehole water samples collected within the perched zone at well R-12. This finding is consistent with the use of small amounts of municipal water for lubrication within clay-rich zones of the Cerros del Rio basalt during drilling (prior to well development). A groundwater sample collected from the regional aquifer during the first sampling event at well R-12 was characterized by $\delta^{18}\text{O}$ and δD ratios of -11.3 and -81 ‰, respectively, and was similar in isotopic composition to that of perched groundwater (Figure 5.1-8). This finding suggests that perched groundwater mixed with regional aquifer groundwater prior to installation of the Westbay® instrumentation at well R-12. Since drilling and well completion and development, however, well R-12 has been reequilibrating with native or predrilling groundwater, and both the perched groundwater and regional aquifer are becoming distinct with respect to their $\delta^{18}\text{O}$ and δD ratios.

The main sources of nitrate found in groundwater and surface water at the Laboratory include (1) natural organic nitrogen in soils and bedrock, (2) nitrate produced from dissociated and treated nitric acid discharges, (3) fertilizers, and (4) treated septic/effluent discharges. Of these possible sources, aqueous discharges of both dissociated nitric acid and treated septic/effluent probably exceed naturally and fertilizer-derived nitrate. During drilling of well R-12, concentrations of nitrate in perched groundwater ranged from 0.21 to 5.5 mg/L between a depth of 443 and 495 ft.

Nitrogen isotopes (nitrogen-15 and nitrogen-14, $\delta^{15}\text{N}_{\text{AIR}}$ of NO_3 and $\delta^{15}\text{N}_{\text{AIR}}\text{-NH}_4$) provide a useful tool for evaluating different sources of nitrogen (nitrate plus nitrite and ammonium) found in the environment. The isotopic standard for $\delta^{15}\text{N}$ is nitrogen in air, which has a value of zero ‰ (Clark and Fritz 1997, 59168). Nitrate derived from treated septic effluent is enriched in nitrogen-15, is depleted in nitrogen-14, and is characterized by positive $\delta^{15}\text{N}$ ratios (+7 to > +30‰) (Clark and Fritz 1997, 59168). During denitrification, which is the reduction of nitrate to nitrogen gas in the presence of organic carbon, residual nitrate becomes enriched in nitrogen-15. Subsequently, $\delta^{15}\text{N}$ ratios become more positive with increasing denitrification.

Groundwater samples collected from the perched zone at well R-12 were analyzed for $\delta^{15}\text{N}_{\text{AIR}}\text{-NO}_3$, with results ranging from -3.7 to +10.2‰ (Table 5.1-1 and 5.1-2). Values of $\delta^{15}\text{N}_{\text{AIR}}\text{-NH}_4$ ranged from -6.1 to +5.6‰ within this perched zone. The negative isotopic value measured in a groundwater sample collected from 468.0 ft suggests enrichment of nitrogen-14. Interestingly, this $\delta^{15}\text{N}_{\text{AIR}}\text{-NO}_3$ value is similar to that measured in a perched zone (-5.6 and -6.7‰) within the Cerros del Rio basalt at borehole R-15 within Mortandad Canyon (Longmire et al. 2001, 70103). Nitrate derived from enriched nitrogen-14 (dissociated nitric acid) was discharged to Mortandad Canyon from 1986 through 1989 (Longmire et al. 2001, 70103). Additional sampling and drilling within Mortandad Canyon and Sandia Canyon is required to determine if these perched zones are interconnected. The positive $\delta^{15}\text{N}_{\text{AIR}}\text{-NO}_3$ value (+10.2‰) measured in a groundwater sample collected during the fourth sampling event for the perched zone (507.0 ft) shows considerable fractionation (enrichment of nitrogen-15) caused by denitrification. This observed value is consistent with $\delta^{15}\text{N}_{\text{AIR}}\text{-NO}_3$ ratios associated with treated sewage effluent. Concentrations of dissolved nitrate plus nitrite (as N) in the perched zone at well R-12 ranged from 0.03 to 0.23 mg/L (Table 5.1-1).

Borehole water samples collected from R-12 were analyzed for ammonium (as N), nitrate (as N), and $\delta^{15}\text{N}$ (Broxton et al. 2001, 71252). These analytical results of nitrogen species and isotopes are presented in Table 5.1-4. Groundwater samples collected from borehole R-12, at depths of 443, 464, 495, and 805 ft, and TA-3 had $\delta^{15}\text{N}_{\text{AIR}}\text{-NO}_3$ ratios ranging from +11.3 to +34.2‰ (Table 5.1-4). A possible source of nitrate in these waters, based on nitrogen isotopic analyses, is the TA-3 treated sewage discharge in upper Sandia Canyon (Broxton et al. 2001, 71252).

Table 5.1-4
Summary of Nitrogen Chemistry and Nitrogen Isotopes for
Borehole R-12 and Treated Effluent Water at TA-3, Upper Sandia Canyon

Well (Sample Depth)	$\text{NO}_3\text{-N}$ (mg/L)	$\text{NH}_4\text{-N}$ (mg/L)	$\delta^{15}\text{N}_{\text{AIR}}\text{-NO}_3$ (‰)	$\delta^{15}\text{N}_{\text{AIR}}\text{-NH}_4$ (‰)	Water Type
R-12 (443 ft)	4.9	<0.02	+15.2 (3)	Insufficient sample volume	Perched
R-12 (464 ft)	0.21	13.5	+21.3 (2)	+1.3 (2)	Perched
R-12 (495 ft)	5.5	0.26	+20.3 (2)	Insufficient sample volume	Perched
R-12 (805 ft)	0.46	0.02	+11.3 (2)	Insufficient sample volume	Regional
TA-3 (treated effluent)	1.5	0.12	+32.4 (2)	Insufficient sample volume	Effluent

Notes: 1. Table modified from Broxton et al. 2001, 71252.
2. Concentrations of nitrate and ammonium in units of ppm; isotopes in units permil or parts per thousand.
3. Nitrogen isotopic analyses performed by Coastal Science Laboratories, Inc., Austin, Texas. The number of isotopic analyses for each sample is given in parentheses.

Ammonium was detected in groundwater collected from borehole R-12 at a depth of 464 ft (Broxton et al. 2001, 71252). Ammonium is the thermodynamically stable form of nitrogen under reducing conditions. The $\delta^{15}\text{N}_{\text{AIR}-\text{NH}_4}$ ratio for the groundwater sample was +1.3‰, implying a different source (abiological) of ammonium than that found in the groundwater samples collected at depths of 443 and 495 ft. The ammonium may be derived from EZ-MUD® and/or from clay minerals through cation exchange. More analysis is required to understand the source(s) of ammonium at well R-12.

Concentrations of nitrate within the perched zone measured during drilling of well R-12 exceeded those measured during characterization sampling (Tables 5.1-1 through 5.1-4). It is possible that denitrification or ammonification has occurred because of the presence of DOC associated with residual EZ-MUD®.

Generally, volatile and semivolatile organic compounds (validated results) were not detected, except for butanone[2-] (1.1 µg/L), which was detected during the fourth sampling round, September 7, 2001, at a depth of 468.0 ft (Appendix A). Bis (2-ethylhexyl) phthalate was detected at a concentration of 3.2 µg/L at this depth during the first sampling event (Appendix A). This compound is a constituent of plastic. Acetone was detected at a concentration of 19.1 µg/L during the fourth sampling round, September 10, 2001, at a depth of 507.0 ft (Appendix A). This compound was also detected at a concentration of 2.4 µg/L (811.0 ft) during the fourth sampling event on September 12, 2001.

The occurrence of acetone (below regulatory limits) at well R-12 is regarded as a false positive for several reasons. QUIKFOAM® used during drilling consists of isopropyl alcohol, which has a molecular weight of 60.1 amu. Acetone has a mass of 58.08 amu, which is very similar to that of isopropyl alcohol. These compounds will elute in nearly the same retention time on a typical GC/MS system following SW-846 Method 8260. The mass units for isopropyl alcohol are (m/z) 45, 43, 59, and 58, and the mass units for acetone are 43 and 58. For qualification purposes, the mass spectrometer uses the mass units and retention time. The analyte must elute in a certain retention-time window and have the correct corresponding mass units for identification. Because of the similar retention times and mass units for both acetone and isopropyl alcohol, these two compounds can be misidentified. This explanation is supported by the mass spectra data. Acetone can be misidentified because the secondary ion for isopropyl alcohol is 43, which is the primary ion for acetone. This misidentification also occurred in groundwater samples collected from wells R-7, R-19, and R-22. HE compounds or their degradation products were not detected at well R-12. Carbon disulfide was detected at a concentration of 1.7 µg/L within the perched zone (507.0 ft) during the first sampling event (Appendix A). Presence of this chemical could be the result of other analytical processes occurring at Paragon Analytics, Inc. The compound was only detected slightly above the MDL of the instrument (GCMS).

Analysis of the DOC fractionation (also termed "humic substances"), which includes both hydrophobic and hydrophilic fractions, was performed on three groundwater samples collected during the fourth event from well R-12 (Appendix A). Both fractions contain acid-, neutral-, and base-organic substances. Hydrophobic acids include humic and fulvic acids (carboxylic acids and phenols), whereas the hydrophobic neutral fraction includes aliphatic organic compounds (Vilks and Bachinski 1996, 71515). Hydrophobic bases include aromatic amines and other nitrogen-containing compounds. The hydrophilic fraction contains low molecular weight (≤ 5 carbon atoms) polyelectrolytic and aliphatic acids (acid fraction), aliphatic amines and amino acids (base fraction), and alcohols, esters, aliphatic amides, and carbohydrates (neutral fraction) (Vilks and Bachinski 1996, 71515). These two DOC fractions are naturally occurring in groundwater (Vilks and Bachinski 1996, 71515) with a median concentration of 0.7 mgC/L (Thurman 1985, 71514). Anthropogenic (man-made) sources, including refined petroleum products, drilling fluids, and high-molecular weight organic compounds, are also possible.

A DOC concentration of 5.0 mgC/L was measured in a groundwater sample collected from the perched zone at well R-12, at a depth of 468.0 ft, on September 7, 2001. This sample contained 3.3 mgC/L

hydrophobic fraction consisting of 2.1 mgC/L acid fraction and 1.2 mgC/L neutral fraction with the base fraction <0.1 mgC/L. The neutral fraction consisted of short chain aliphatic compounds as breakdown products of the EZ-MUD® copolymer. The base fraction consisted of amino acids and other nitrogen-related compounds. The groundwater also contained 1.6 mgC/L hydrophilic fraction, which consisted of 1.2, 0.1, and 0.3 mgC/L acid, neutral, and base fractions, respectively.

Approximately 21% of the humic and fulvic acids (hydrophobic acid fraction in the perched zone at 468.0 ft) were calculated to form a complex with calcium. (See Table 6.2-1.) The majority of humic and fulvic acids are stable as noncomplexed anions. Formation of calcium-humate and/or calcium-fulvate complexes did not influence the stability of CaCO₃ (calcite) according to MINTEQA2 simulations. The origin of DOC in groundwater at well R-12 includes natural sources and/or residual fluids from drilling and/or well completion. The neutral and base fractions may consist of residual EZ-MUD® copolymer and aliphatic compounds.

A DOC concentration of 1.8 mgC/L, which is typical for baseline groundwater beneath the Pajarito Plateau, was measured in a groundwater sample collected from the perched zone at well R-12 at a depth of 507.0 ft on September 10, 2001. This sample contained 1.0 mgC/L hydrophobic fraction consisting of 0.4 mgC/L acid fraction and 0.6 mgC/L neutral fraction with the base fraction less than detection (<0.1 mgC/L). The groundwater also contained 0.8 mgC/L hydrophilic fraction, which consisted of 0.5, 0.2, and 0.1 mgC/L acid, neutral, and base fractions, respectively.

A DOC concentration of 1.1 mgC/L was measured in a groundwater sample collected from the regional aquifer at well R-12, at a depth of 811.0 ft, on September 12, 2001. This sample contained 0.6 mgC/L hydrophobic fraction consisting of 0.2 mgC/L acid fraction and 0.4 mgC/L neutral fraction with the base fraction less than detection (<0.1 mgC/L). The groundwater also contained 0.5 mgC/L hydrophilic fraction, which consisted of 0.3 mgC/L acid fraction and 0.2 mgC/L neutral fraction with the base fraction <0.1 mgC/L.

5.2 Comparison to Wells R-9 and R-9i

Well R-9 is completed at the regional water table (single screen with regional water table at 668 ft within the Santa Fe Group basalt) and provides a comparison for water chemistry with well R-12. Dissolved manganese concentrations in the regional aquifer at well R-12 exceeded those reported by Longmire (2002, 72713) for characterization well R-9 (range of 0.071 to 0.190 mg/L) in upper Los Alamos Canyon. Average concentrations of dissolved manganese in the regional aquifer at well R-12 were 0.66 mg/L. Concentrations of manganese at well R-12 exceeded the EPA and NMWQCC standards of 0.05 mg/L and 0.2 mg/L, respectively, during characterization sampling (Table 5.1-3, Appendix A).

Concentrations of natural dissolved iron, manganese, and nickel in the perched zone at well R-12 were less than those reported by Longmire (2002, 72713) at characterization well R-9i, completed in the Cerros del Rio basalt in Los Alamos Canyon. Dissolved concentrations of iron, manganese, and nickel ranged from 0.70 to 2.30 mg/L, from 0.487 to 1.00 mg/L, and from 0.039 to 0.140 mg/L, respectively, at well R-9i. Well R-12, however, has been reequilibrating with groundwater, and concentrations of these constituents were generally decreasing during characterization sampling. Concentrations of other trace elements and trace metals observed at well R-12 were within the ranges for samples collected from well R-9i (Longmire 2002, 72713).

6.0 GROUNDWATER GEOCHEMICAL CALCULATIONS

6.1 Computer Program Selection

Results of geochemical calculations suggest that groundwater chemistry and mineral stability are evolving at well R-12 as drilling fluid breaks down or oxidizes. Equilibrium conditions should become reestablished after residual drilling fluid has been removed from the well. Geochemical calculations of groundwater samples collected from well R-12 were conducted to evaluate speciation of solutes (dissolved species) and to quantify the state of saturation of solid phases that control groundwater composition under equilibrium conditions. These calculations provided insight into processes that control water/rock interactions, including mineral precipitation and adsorption occurring in both natural and contaminated waters. Geochemical calculations of water were conducted to evaluate geochemical processes influencing natural water composition, dissociation of drilling fluids, and contaminant chemistry and transport.

Calculations of solute speciation, PCO_2 gas, and solid-phase saturation indices were made using the computer program MINTEQA2 (Allison et al. 1991, 49930), with single-ion activity coefficients calculated using the Davies equation. MINTEQA2 was developed by Battelle Northwest for the EPA for use at RCRA and Superfund sites. The model is constrained by solute concentrations and involves silicate, calcium carbonate, and clay minerals identified by Broxton et al. (2001, 71252) at well R-12. MINTEQA2 quantifies possible rock/water and water/atmosphere reactions, but modeling results should be interpreted with caution and are limited by the scope of our understanding of hydrologic flow conditions (saturated and unsaturated), possible reaction mechanisms, and kinetic constraints in a disequilibrium-dominated system. One source of error in using the computer program is the accuracy of the thermochemical data contained in the database. Errors are greater for trace solutes for which experimental data are inaccurate and/or incomplete, including thallium, beryllium, and cadmium. The uranium database contained in MINTEQA2 has been critically evaluated by Grenthe et al. (1992, 71511). Fewer errors are associated with the major ions and with solid phases consisting of carbonate, silicate, and oxyhydroxide minerals (Langmuir 1997, 56037).

6.2 Speciation Calculations

Speciation calculations using the computer program MINTEQA2 (Allison et al. 1991, 49930) were performed to evaluate stable forms of dissolved solutes, which influence mineral precipitation and adsorption reactions occurring in natural and contaminated waters. Fate and transport of natural manganese and anthropogenic (man-made) ammonium observed at well R-12 are controlled by both aqueous speciation and adsorption/desorption processes. Input files for the calculations are provided in Appendix B. Solutes of importance at well R-12 include major ions, TKN, ammonium, and manganese. Results of the speciation calculations are provided in Tables 6.2-1 through 6.2-3.

Concentrations of dissolved iron in the perched zone at well R-12 were less than detection for the first and third sampling rounds conducted on September 18, 2000, and June 13, 2001. When detected, ferrous iron is predicted to be mainly stable as dissolved Fe^{2+} . The hydrolysis species FeOH^+ is a minor component (not shown in Tables 6.2-1 and 6.2-2). The free or uncomplexed Fe^{2+} cation is available for adsorption and precipitation reactions. Uranium(IV) is predicted to be stable as U(OH)_4^0 in the presence of TOC and DOC above 1 mgC/L; this hydrolysis species is semisorbing onto mineral surfaces and enhances the precipitation of UO_2am , UO_2 , and USiO_4 (Langmuir 1997, 56037). Concentrations of total and dissolved uranium are less than 1 $\mu\text{g}/\text{L}$ in the perched zone at well R-12.

Manganese is predicted to be stable as Mn^{2+} , and this species can undergo cation exchange with other divalent cations and surface complexation adsorption with metal (oxy)hydroxides (Langmuir 1997,

56037). Concentrations of natural manganese occurred in the perched zone, ranging from 0.043 to 0.86 mg/L at well R-12. The complex MnHCO_3^+ is calculated to be stable in concentrations less than 5% of the total manganese present within the perched groundwater. Major ions consisting of Ca^{2+} , Mg^{2+} , Na^+ , K^+ , Cl^- , SO_4^{2-} , and HCO_3^- (not shown in Tables 6.2-1 and 6.2-2) are calculated to be stable as free or uncomplexed solutes at well R-12.

Table 6.2-1
Results of Speciation Calculations Using MINTEQA2 for
Well R-12 (Perched Zone, 468.0 ft), Upper Sandia Canyon

Solute	Dominant Speciation	Percentage	Sample Date (mo/d/yr)
Mn(II)	Mn^{2+}	95.3	09/18/00
Mn(II)	Mn^{2+}	97.2	03/14/01
Mn(II)	Mn^{2+}	97.4	06/13/01
Mn(II)	Mn^{2+}	97.1	09/07/01
Mn(II)	MnHCO_3^+	4.1	09/18/00
Mn(II)	MnHCO_3^+	2.6	03/14/01
Mn(II)	MnHCO_3^+	1.8	06/13/01
Mn(II)	MnHCO_3^+	1.3	09/07/01
N(-III)	NH_4^+	95.8	09/18/00
N(-III)	NH_4^+	99.8	03/14/01
N(-III)	NH_4^+	86.2	06/13/01
N(-III)	NH_4^+	73.3	09/07/01
N(-III)	NH_3^0	4.1	09/18/00
N(-III)	NH_3^0	0.2	03/14/01
N(-III)	NH_3^0	13.8	06/13/01
N(-III)	NH_3^0	26.7	09/07/01
U(IV)	U(OH)_4^0	100	09/18/00
U(IV)	U(OH)_4^0	100	03/14/01
U(IV)	U(OH)_4^0	100	06/13/01
DOM ^a	DOM	78.2	09/07/01
DOM	Ca-DOM	21.0	09/07/01

^a DOM = dissolved organic matter.

Table 6.2-2
Results of Speciation Calculations Using MINTEQA2 for
Well R-12 (Perched Zone, 507.0 ft), Upper Sandia Canyon

Solute	Dominant Speciation	Percentage	Sample Date (mo/d/yr)
Mn(II)	Mn^{2+}	96.6	09/19/00
Mn(II)	Mn^{2+}	97.6	03/15/01
Mn(II)	Mn^{2+}	96.8	06/13/01
Mn(II)	Mn^{2+}	96.4	09/10/01
Mn(II)	MnHCO_3^+	1.7	09/19/00
Mn(II)	MnHCO_3^+	1.5	03/15/01
Mn(II)	MnHCO_3^+	1.6	06/13/01
Mn(II)	MnHCO_3^+	1.3	09/10/01
N(-III)	NH_4^+	86.1	06/13/01
N(-III)	NH_4^+	73.3	09/10/01
N(-III)	NH_3^0	13.8	06/13/01
N(-III)	NH_3^0	26.6	09/10/01
U(IV)	U(OH)_4^0	100	09/19/00

Table 6.2-2 (continued)

Solute	Dominant Speciation	Percentage	Sample Date (mo/d/yr)
U(IV)	U(OH)_4^0	100	03/15/01
U(IV)	U(OH)_4^0	100	06/13/01
U(IV)	U(OH)_4^0	100	09/10/01

Table 6.2-3
Results of Speciation Calculations Using MINTEQA2 for
Well R-12 (Regional Aquifer, 811.0 ft), Upper Sandia Canyon

Solute	Dominant Speciation	Percentage	Sample Date (mo/d/yr)
Mn(II)	Mn^{2+}	94.5	09/20/00
Mn(II)	Mn^{2+}	94.5	03/16/01
Mn(II)	Mn^{2+}	94.8	06/14/01
Mn(II)	Mn^{2+}	94.4	09/12/01
Mn(II)	MnHCO_3^+	4.1	09/20/01
Mn(II)	MnHCO_3^+	4.1	03/16/01
Mn(II)	MnHCO_3^+	4.3	06/14/01
Mn(II)	MnHCO_3^+	4.4	09/12/01
U(IV)	U(OH)_4^0	100	09/20/00
U(IV)	U(OH)_4^0	100	03/16/01
U(IV)	U(OH)_4^0	100	06/14/01
U(IV)	U(OH)_4^0	100	09/12/01
U(VI)	$\text{UO}_2(\text{CO}_3)_2^{2-}$	66.1	06/14/01
U(VI)	$\text{UO}_2(\text{CO}_3)_3^{4-}$	31.3	06/14/01
U(VI)	$\text{UO}_2(\text{CO}_3)_2^{2-}$	64.6	09/12/01
U(VI)	$\text{UO}_2(\text{CO}_3)_3^{4-}$	33.0	09/12/01

Concentrations of dissolved iron in the regional aquifer at well R-12 were less than detection for the third and fourth sampling rounds conducted on September 18, 2000, and June 13, 2001. Iron(II) is predicted to be stable as dissolved Fe^{2+} , and the hydrolysis species FeOH^+ is a minor component (not shown in Table 6.2-3). Uranium(IV) is predicted to be stable as U(OH)_4^0 , in the presence of TOC and DOC above 1 mgC/L (first and second sampling events). Concentrations of total and dissolved uranium increased during the characterization sampling; however, they were less than 2 $\mu\text{g}/\text{L}$ in the regional aquifer at well R-12. Uranyl dicarbonate and tricarbonate complexes were calculated to be stable during the third and fourth sampling events, which is consistent with gradual reoxidation of the regional aquifer at R-12. Ammonium dominated over ammonia below pH 9.28 at 25 C, and this cation can undergo cation exchange with other monovalent metals. Equilibrium between ammonium and ammonia shifted to lower pH values with decreasing temperatures.

Manganese is predicted to be stable as Mn^{2+} , and this species can undergo cation exchange with other divalent cations and surface complexation adsorption with metal (oxy)hydroxides (Langmuir 1997, 56037). Concentrations of natural manganese occurred in the regional aquifer, ranging from 0.34 to 1.10 mg/L at well R-12. The complex MnHCO_3^+ was calculated to be present between 3% and 5% of total manganese distributions within the regional aquifer. Major ions consisting of Ca^{2+} , Mg^{2+} , Na^+ , K^+ , Cl^- , SO_4^{2-} , and HCO_3^- (not shown in Table 6.2-3) were calculated to be stable as free or uncomplexed solutes at well R-12. Dissolved organic matter (DOM), consisting of humic and fulvic acids (hydrophobic acid fraction), was calculated by MINTEQA2 to include mainly noncomplexed solutes and a calcium-DOM complex (Table 6.2-1).

Results of speciation calculations showed that cationic trace metals and nutrients (iron, manganese, and ammonium) were stable in groundwater. Iron, manganese, and ammonium potentially are removed from solution by cation exchange and adsorption (surface complexation) under circumneutral pH conditions. Migration of reduced uranium [U(IV)] was calculated to be minimal, based on speciation calculations for well R-12, which enhances precipitation of USiO_4 .

6.3 Saturation Index Calculations

Solid-solution phase calculations were performed with MINTEQA2 (Allison et al. 1991, 49930) using analytical results obtained from filtered (less than 0.45 μm membrane) groundwater samples collected at well R-12. The saturation index (SI) is a measure of the degree of saturation, undersaturation, or oversaturation of a solid phase in water ($\text{SI} = \log_{10} \{\text{activity product}/\text{solubility product}\}$; at equilibrium $\text{SI} = 0 \pm 0.05$) (Langmuir 1997, 56037). The purpose of the calculations was to assess the importance of precipitation reactions for controlling the transport of manganese, uranium, and other solutes at well R-12.

Figure 6.3-1 shows the values of the SI for several key phases for well R-12 in the perched zone (468.0 ft). Groundwater in the perched zone at well R-12 is calculated to be undersaturated with respect to BaSO_4 (barite), SrCO_3 (strontianite), and amorphous silica phases (Figures 6.3-1 and 6.3-2). Groundwater is calculated to be both undersaturated and oversaturated with respect to USiO_4 (coffinite), CaCO_3 (calcite), FeCO_3 (siderite) [when iron(II) is present above instrument detection limit], and MnCO_3 (rhodochrosite). Decreasing carbonate alkalinity, calcium concentrations, temperature, and pH contribute to calcite undersaturation in the perched zone. Groundwater is calculated to be oversaturated with respect to calcite and rhodochrosite at a depth of 507.0 ft, during the first sampling event conducted on September 19, 2000 (Figure 6.3-2). Calcium carbonate (calcite) is present in the older alluvium at well R-12 (Broxton et al. 2001, 71252).

These results are generally consistent with observed mineralogy (presence of calcium carbonate and absence of strontium carbonate) in the older alluvium at well R-12. Calculated $\log_{10}\text{PCO}_2$ gas varied from -4.18 to -1.83 atmosphere for perched water at well R-12 groundwater. Variation in the SI values for FeCO_3 , CaCO_3 , SrCO_3 , and PCO_2 gas is the result of differing temperature, carbonate alkalinity, pH, and activities of iron, calcium, and strontium in groundwater at well R-12.

Results of mineral saturation calculations for well R-12 (regional aquifer) are shown in Figure 6.3-3. The regional aquifer is calculated to be undersaturated with respect to BaSO_4 , MnCO_3 , FeCO_3 , SrCO_3 , and silica precipitate (Figure 6.3-3). Groundwater is calculated to be oversaturated with respect to USiO_4 (coffinite) and in equilibrium with silica gel (Figure 6.3-3). Groundwater shows increasing saturation with respect to $\text{Ca}(\text{UO}_2)_2(\text{Si}_2\text{O}_5)_3 \cdot 5\text{H}_2\text{O}$ (haiweeite), based on increasing concentrations of dissolved uranium [U(VI)] observed at well R-12. Depletion of chemical reductants contained in residual drilling fluids increases the redox potential, and as groundwater becomes more oxidizing, uranium(VI) species dominate over uranium(IV) species. Calculated $\log_{10}\text{PCO}_2$ gas varies from -2.24 to -1.52 atmosphere for the regional aquifer at well R-12, which is controlled by pH, carbonate alkalinity, and temperature of the perched groundwater. Groundwater is calculated to be both saturated and undersaturated with respect to CaCO_3 (calcite). Variation in the SI values for CaCO_3 and SrCO_3 at well R-12 is the result of differing temperatures, carbonate alkalinity, pH, and activities of calcium and strontium in groundwater.

Because of varying pH, alkalinity, temperature, and concentrations of calcium, manganese, strontium, and uranium, SI for the above minerals vary by 2.4 orders of magnitude. These calculations suggest that well R-12 is continuously reequilibrating with groundwater entering the well screens. When equilibrium conditions are established, and drilling fluid is removed from the well, less variation in saturation indices and partial pressure of carbon dioxide gas is expected.

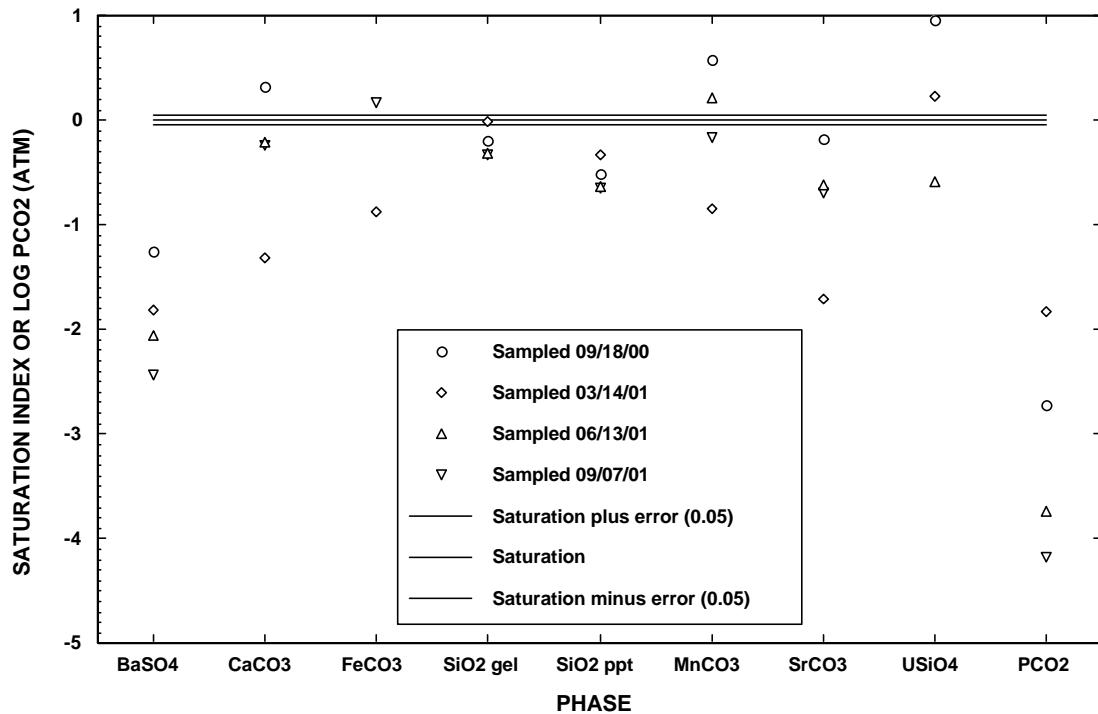


Figure 6.3-1. Results of saturation index calculations using MINTEQA2 for well R-12 (perched zone, 468.0 ft), upper Sandia Canyon

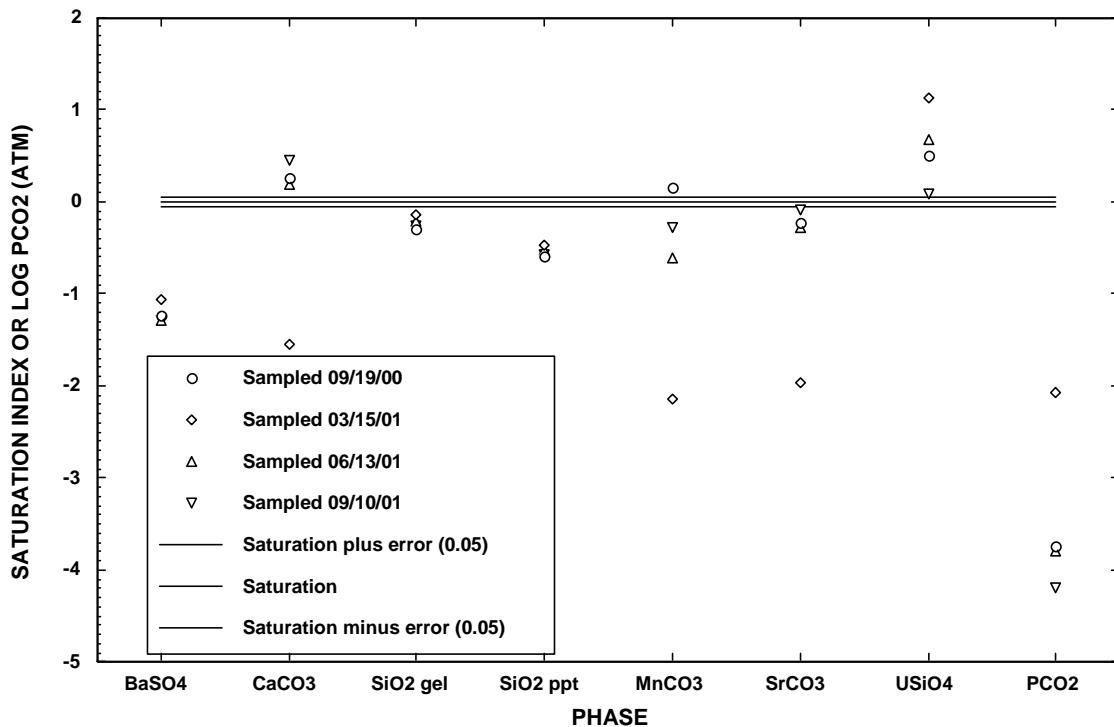


Figure 6.3-2. Results of saturation index calculations using MINTEQA2 for well R-12 (perched zone, 507.0 ft), upper Sandia Canyon

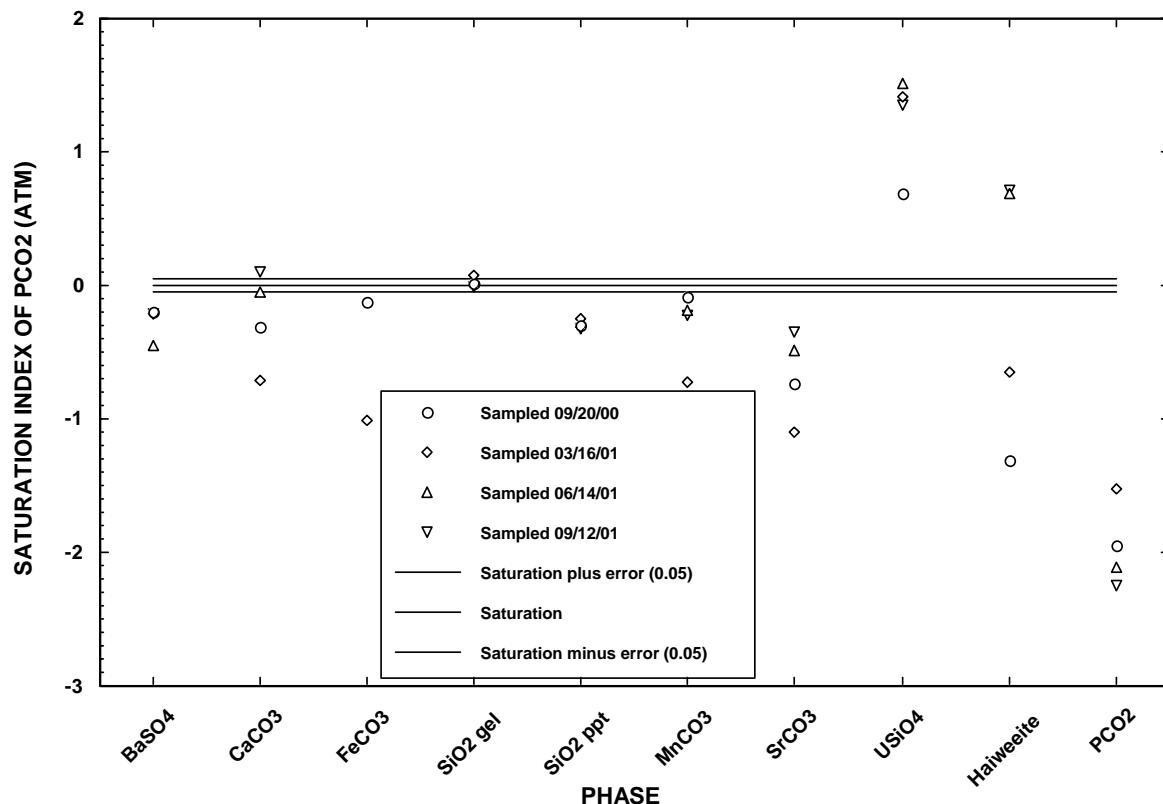


Figure 6.3-3. Results of saturation index calculations using MINTEQA2 for well R-12 (regional aquifer, 811.0 ft), upper Sandia Canyon

7.0 CONCLUSIONS

Four rounds of groundwater characterization samples were collected at well R-12 at pump intake depths of 468.0, 507.0, and 811.0 ft. These samples were chemically characterized for radionuclides, metals and trace elements, major ions, HE compounds, DOC, TOC, organic compounds, and stable isotopes. Americium-241, cesium-137, plutonium-238, plutonium-239,240, and strontium-90 were not detected in the groundwater samples collected from well R-12. Activities of tritium at well R-12 ranged from 49.8 to 192 pCi/L, suggesting that a component of sampled groundwater is less than 60 years old and postdates the beginning of nuclear testing (based on the cosmogenic baseline of tritium of 1 pCi/L prior to testing). Activities of uranium-234, uranium-235, and uranium-238 were detected at concentrations less than 1.5 pCi/L. Gross alpha and gross beta activities were generally less than detection with detectable activities less than 7 pCi/L. Measurable gross gamma was attributed to isotopes within the natural uranium-238, uranium-235, and thorium-232 decay chains.

Concentrations of dissolved manganese at well R-12 in the perched zone (468.0 ft) and in the regional aquifer (811.0 ft) exceeded the NMWQCC standard of 0.2 mg/L for domestic water supply.

Concentrations of natural iron and manganese also exceeded EPA drinking water secondary standards for nonfiltered iron (0.3 mg/L) and manganese (0.05 mg/L). Natural sources of abundant manganese and iron were found in the basalts encountered during well drilling. Elevated concentrations of natural manganese and iron probably result from reductive dissolution of ferric (oxy)hydroxide and manganese dioxide under reducing conditions when residual drilling fluids are present. However, the standards established for these two metals are based on aesthetic properties such as taste, odor, and color.

Concentrations of other metals and trace elements were below their respective MCLs at well R-12 in screens #1, #2, and #3.

Groundwater from the perched zone in well R-12 ranges from a calcium-sodium bicarbonate type to a sodium-calcium-bicarbonate type. Perched groundwater, represented by eight samples collected at depths of 468.0 and 507.0 ft, was found to contain an average of 141 pCi/L tritium, 1.31 mg/L dissolved ammonium (as N), 1.55 mg/L dissolved TKN, 0.00034 mg/L (0.34 µg/L) dissolved uranium, 0.269 mg/L dissolved manganese, 9.35 mg/L dissolved chloride, 0.51 mg/L dissolved fluoride, and 4.73 mg/L dissolved sulfate. Concentrations of nitrate plus nitrite (as N), when detected, were less than 0.3 mg/L. Ammonium and TKN were the dominant nitrogen species present in perched groundwater collected from well R-12. Concentrations of perchlorate were less than detection (0.001–0.004 mg/L) in the perched zone at well R-12.

Reducing conditions with respect to nitrogen (ammonium and TKN) and manganese dominated in the perched zone because of the presence of organic reductants derived from the oxidation of drilling fluids. Based on chemical data collected during drilling of R-12, native groundwater, however, was oxidizing with respect to manganese and nitrogen (Broxton et al. 2001, 71252). Nitrate was the dominant nitrogen species found in the borehole groundwater at the well site.

Regional aquifer groundwater at well R-12 is characterized by a calcium-sodium-bicarbonate ionic composition. This groundwater, represented by four samples, was found to contain an average of 63.4 pCi/L tritium, 0.31 mg/L dissolved TKN, 0.0014 mg/L (1.4 µg/L) dissolved uranium, 0.66 mg/L dissolved manganese, 9.35 mg/L dissolved chloride, 0.36 mg/L dissolved fluoride, and 12.6 mg/L dissolved sulfate. Concentrations of nitrate plus nitrite (as N) were less than 0.2 mg/L. Concentrations of perchlorate were less than detection (0.001–0.004 mg/L) in the regional aquifer at well R-12.

Stable isotope ratios of δD and $\delta^{18}O$ imply that the sampled groundwater at well R-12 was derived from a local meteoric source consisting of precipitation and surface water, although the source of recharge is different for perched and regional aquifer groundwater. Results of $\delta^{15}N_{AIR}-NO_3$ analyses suggest that nitrate plus nitrite (as N) was derived from depleted nitrogen-15 (-3.7‰) and from treated sewage discharges (+10.2‰) within upper Sandia Canyon. Ammonium and TKN within the perched zone were derived from residual drilling fluid such as EZ-MUD® ($\delta^{15}N_{AIR}-NH_4$ of -0.8‰) and ammonification or reduction of both depleted and enriched nitrogen-15 ($\delta^{15}N_{AIR}-NH_4$ of -6.1 and +5.6‰). Multiple sources of nitrate and ammonium occurred at well R-12 based on $\delta^{15}N$ distributions in the perched groundwater. More analyses of stable isotopes of nitrogen are required to understand distribution of nitrogen species at well R-12.

Geochemical calculations using the computer program MINTEQA2 were performed to evaluate solute speciation and mineral equilibrium in assessing groundwater chemistry and refining the geochemical conceptual model for well R-12. Results of geochemical calculations suggest that groundwater composition and mineral stability are evolving at well R-12 because of the breakdown or oxidation of residual drilling fluid. Equilibrium conditions should become reestablished after drilling fluid has been removed from the well. The regional aquifer at well R-12 is undersaturated with respect to amorphous silica precipitate or volcanic glass, $BaSO_4$, $MnCO_3$, $FeCO_3$, and $SrCO_3$. This groundwater is calculated to be oversaturated with respect to $USiO_4$ and is in equilibrium with silica gel. The regional aquifer shows variable saturation with respect to $CaCO_3$ and $Ca(UO_2)_2(Si_2O_5)_3 \cdot 5H_2O$. Uranium(IV) is calculated to be stable as $U(OH)_4^0$ under induced reducing conditions characterized by elevated concentrations of TOC and DOC at well R-12. After depletion of residual drilling fluids, uranium(VI) complexes including $UO_2(CO_3)_2^{2-}$ and $UO_2(CO_3)_3^{4-}$ are expected to dominate at well R-12 under oxidizing conditions typically characteristic of the regional aquifer. The perched zone in well R-12 is generally undersaturated with respect to amorphous silica phases or volcanic glass, $BaSO_4$, and $SrCO_3$, and oversaturated with respect

to USiO_4 . This groundwater shows variable saturation with respect to MnCO_3 and CaCO_3 . A decrease in both carbonate alkalinity and pH results in undersaturation with respect to MnCO_3 and CaCO_3 (both calcite and aragonite) at well R-12. Based on variation in mineral stability, geochemical calculations suggest that groundwater at well R-12 has not reached complete equilibrium with solid phases in aquifer material in the presence of residual drilling fluid.

8.0 ACKNOWLEDGEMENTS

The following individuals contributed to the geochemical investigation conducted during characterization sampling at well R-12.

B. Hardesty and A. Groffman provided data management.

J. Kofoed and D. Steven collected groundwater samples and recorded field parameters at well R-12.

The groundwater integration team, led by C. Nylander, participated in the planning of data collection during the investigation.

R. Enz provided DOE oversight during the investigation.

D. Broxton, A. Groffman, E. Louderbough, J. McCann, D. Rogers, T. Whitacre, and W. Woodworth were reviewers for the document.

M. Sachdeva was editor for this document. P. Maestas and R. Moore were compositors.

D. Broxton and J. McCann supported this investigation as leaders of the Groundwater Investigations Focus Area.

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Appendix A

Groundwater Analytical Results

Table A-1
Regional Well R-12 Screen 1 First Round Sample Results: Data Summary for Inorganic Chemicals

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Field Parameter												
Field Alkalinity (total as CaCO ₃)	1	468	9/18/00	NF ^e	1	0	— ^f	—	—	—	—	—
pH	1	468	9/18/00	NF	1	1	8.01	—	—	>6 & <9	0/1	>6 & <9
Specific Conductance (µS/cm)	1	468	9/18/00	NF	1	1	280	—	—	0/1	—	0/1
Temperature (°C)	1	468	9/18/00	NF	1	1	21.8	—	—	0/1	—	0/1
Turbidity (NTU ^g)	1	468	9/18/00	NF	1	1	3.3	—	—	0/1	—	0/1
Analyte												
Lab Alkalinity (total as CaCO ₃)	1	468	9/18/00	F	1	1	170000	—	—	—	—	—
Lab Alkalinity (total as CaCO ₃)	1	468	9/18/00	NF	1	1	170000	—	—	—	—	—
Aluminum	1	468	9/18/00	F ^h	1	0	—	[7.9]	50	0/1	5000	0/1
Aluminum	1	468	9/18/00	NF	1	0	—	[7.9]	—	—	—	—
Ammonia (as N)	1	468	9/18/00	F	1	1	1100	—	—	—	—	—
Ammonia (as N)	1	468	9/18/00	NF	1	1	950	—	—	—	—	—
Antimony	1	468	9/18/00	F	1	1	1.28	—	6	0/1	—	—
Antimony	1	468	9/18/00	NF	1	0	—	[0.683]	—	—	—	—
Arsenic	1	468	9/18/00	F	1	0	—	[3.4]	50	0/1	100	0/1
Arsenic	1	468	9/18/00	NF	1	0	—	[3.4]	—	—	—	—
Barium	1	468	9/18/00	F	1	1	38	—	2000	0/1	1000	0/1
Barium	1	468	9/18/00	NF	1	1	42	—	—	—	—	—
Beryllium	1	468	9/18/00	F	1	0	—	[0.01]	4	0/1	—	—
Beryllium	1	468	9/18/00	NF	1	0	—	[0.01]	—	—	—	—
Boron	1	468	9/18/00	F	1	1	96	—	—	—	750	0/1
Boron	1	468	9/18/00	NF	1	1	99	—	—	—	—	—

Table A-1 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Frequency of Detects > Drinking Water MCL ^b (µg/L)	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Bromide	1	468	9/18/00	F	1	0	—	[200]	—	—	—
Bromide	1	468	9/18/00	NF	1	0	—	[200]	—	—	—
Cadmium	1	468	9/18/00	F	1	0	—	[0.13]	5	0/1	0/1
Cadmium	1	468	9/18/00	NF	1	0	—	[0.13]	—	—	—
Calcium	1	468	9/18/00	F	1	1	30000	—	—	—	—
Calcium	1	468	9/18/00	NF	1	1	30000	—	—	—	—
Carbonate (as CaCO ₃)	1	468	9/18/00	F	1	0	—	[20000]	—	—	—
Carbonate (as CaCO ₃)	1	468	9/18/00	NF	1	0	—	[20000]	—	—	—
Chloride	1	468	9/18/00	F	1	1	16000	—	250000	0/1	250000 0/1
Chloride	1	468	9/18/00	NF	1	1	16000	—	—	—	—
Chromium	1	468	9/18/00	F	1	0	—	[0.33]	100	0/1	50 0/1
Chromium	1	468	9/18/00	NF	1	0	—	[0.33]	—	—	—
Cobalt	1	468	9/18/00	F	1	1	0.46	—	—	—	50 0/1
Cobalt	1	468	9/18/00	NF	1	1	0.79	—	—	—	—
Copper	1	468	9/18/00	F	1	0	—	[0.3]	1300	0/1	1000 0/1
Copper	1	468	9/18/00	NF	1	0	—	[2.6]	—	—	—
Cyanide (total)	1	468	9/18/00	NF	1	0	—	[10]	—	—	—
Fluoride	1	468	9/18/00	NF	1	1	550	—	4000	0/1	1600 0/1
Iron	1	468	9/18/00	F	1	0	—	[160]	300	0/1	1000 0/1
Iron	1	468	9/18/00	NF	1	1	1200	—	—	—	—
Lead	1	468	9/18/00	F	1	0	—	[0.01]	15	0/1	50 0/1
Lead	1	468	9/18/00	NF	1	1	0.748	—	—	—	—
Magnesium	1	468	9/18/00	F	1	1	9000	—	—	—	—
Magnesium	1	468	9/18/00	NF	1	1	9000	—	—	—	—
Manganese	1	468	9/18/00	F	1	1	860	—	50	1/1	200 1/1

Table A-1 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Frequency of Detects > Drinking Water MCL ^b (µg/L)	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Manganese	1	468	9/18/00	NF	1	1	890	—	—	—	—
Mercury	1	468	9/18/00	F	1	0	—	[0.0092]	2	0/1	—
Mercury	1	468	9/18/00	NF	1	0	—	[0.0092]	—	—	0/1
Molybdenum	1	468	9/18/00	F	1	1	21	—	—	—	—
Molybdenum	1	468	9/18/00	NF	1	1	23	—	—	—	—
Nickel	1	468	9/18/00	F	1	1	5.1	—	100	0/1	200/0/1
Nickel	1	468	9/18/00	NF	1	1	5.6	—	—	—	—
Nitrate + Nitrite (as N)	1	468	9/18/00	F	1	0	—	[100]	10000	0/1	—
Nitrate + Nitrite (as N)	1	468	9/18/00	NF	1	0	—	[100]	—	—	—
Perchlorate	1	468	9/18/00	F	1	0	—	[1.04]	—	—	—
Perchlorate	1	468	9/18/00	NF	1	0	—	[1.04]	—	—	—
Phosphorus (total)	1	468	9/18/00	F	1	0	—	[50]	—	—	—
Phosphorus (total)	1	468	9/18/00	NF	1	1	100	—	—	—	—
Potassium	1	468	9/18/00	F	1	1	4500	—	—	—	—
Potassium	1	468	9/18/00	NF	1	1	4500	—	—	—	—
Selenium	1	468	9/18/00	F	1	0	—	[2.6]	50	0/1	50/0/1
Selenium	1	468	9/18/00	NF	1	0	—	[2.6]	—	—	—
Silica	1	468	9/18/00	F	1	1	34080	—	—	—	—
Silica	1	468	9/18/00	NF	1	1	34080	—	—	—	—
Silver	1	468	9/18/00	F	1	0	—	[0.45]	100	0/1	50/0/1
Silver	1	468	9/18/00	NF	1	0	—	[0.45]	—	—	—
Sodium	1	468	9/18/00	F	1	1	26000	—	—	—	—
Sodium	1	468	9/18/00	NF	1	1	26000	—	—	—	—
Strontium	1	468	9/18/00	F	1	1	130	—	—	—	—
Strontium	1	468	9/18/00	NF	1	1	130	—	—	—	—
Sulfate	1	468	9/18/00	F	1	1	3600	—	250000	0/1	600000/0/1
Sulfate	1	468	9/18/00	NF	1	1	3600	—	—	—	—

Table A-1 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detect Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Thallium	1	468	9/18/00	F	1	0	—	[0.026]	2	0/1	—	—
Thallium	1	468	9/18/00	NF	1	0	—	[0.093]	—	—	—	—
Total Kjeldahl Nitrogen	1	468	9/18/00	F	1	1	910	—	—	—	—	—
Total Kjeldahl Nitrogen	1	468	9/18/00	NF	1	1	760	—	—	—	—	—
Uranium by ICPMS ⁱ	1	468	9/18/00	F	1	1	0.927	—	—	—	—	—
Uranium by ICPMS	1	468	9/18/00	NF	1	1	0.919	—	—	—	—	—
Uranium by KPA ^j	1	468	9/18/00	F	1	1	0.86	—	—	—	—	—
Uranium by KPA	1	468	9/18/00	NF	1	1	0.86	—	—	—	—	—
Vanadium	1	468	9/18/00	F	1	0	—	[0.33]	—	—	—	—
Vanadium	1	468	9/18/00	NF	1	0	—	[0.33]	—	—	—	—
Zinc	1	468	9/18/00	F	1	0	—	[9.3]	5000	0/1	10000	0/1
Zinc	1	468	9/18/00	NF	1	0	—	[7.8]	—	—	—	—
Stable Isotope (‰)												
δD	1	468	9/18/00	NF	1	1	-84	—	—	—	—	—
δ ¹⁵ N – NH ₄	1	468	9/18/00	NF	1	1	+5.6	—	—	—	—	—
δ ¹⁵ N – NO ₃	1	468	9/18/00	NF	1	1	ISV ^k	—	—	—	—	—
δ ¹⁸ O	1	468	9/18/00	NF	1	1	-11.4	—	—	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from National Primary Drinking Water Regulations, 40 CFR Part 141. US EPA secondary MCLs are from National Secondary Drinking Water Regulations, 40 CFR Part 143. State of New Mexico MCLs are from Drinking Water Regulations, 20 NMAC 7.1.^c NMED = New Mexico Environment Department.^d State of New Mexico groundwater standards are from New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection, 20 NMAC 6.2.^e NF = Nonfiltered.^f — = Not available or not applicable.^g NTU = Nephelometric turbidity unit.^h F = Filtered.ⁱ ICPMS = Inductively coupled plasma mass spectrometry.^j KPA = Kinetic phosphorescence analysis.^k ISV = Insufficient sample volume.

Table A-2
Regional Well R-12 Screen 2 First Round Sample Results: Data Summary for Inorganic Chemicals

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMEDC Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Field Parameter												
Field Alkalinity (total as CaCO ₃)	2	507	9/19/00	NF ^e	1	0	— ^f	—	—	—	—	—
pH	2	507	9/19/00	NF	1	1	8.62	—	>6 & <9	0/1	>6 & <9	0/1
Specific Conductance (µS/cm)	2	507	9/19/00	NF	1	1	200	—	—	0/1	—	0/1
Temperature (°C)	2	507	9/19/00	NF	1	1	23.6	—	—	0/1	—	0/1
Turbidity (NTU ^g)	2	507	9/19/00	NF	1	1	2.8	—	—	0/1	—	0/1
Analyte												
Lab Alkalinity (total as CaCO ₃)	2	507	9/19/00	F	1	1	64000	—	—	—	—	—
Lab Alkalinity (total as CaCO ₃)	2	507	9/19/00	NF	1	1	63000	—	—	—	—	—
Aluminum	2	507	9/19/00	F ^h	1	0	—	[7.9]	50	0/1	5000	0/1
Aluminum	2	507	9/19/00	NF	1	0	—	[7.9]	—	—	—	—
Ammonia (as N)	2	507	9/19/00	F	1	0	—	[500]	—	—	—	—
Ammonia (as N)	2	507	9/19/00	NF	1	0	—	[500]	—	—	—	—
Antimony	2	507	9/19/00	F	1	0	—	[0.663]	6	0/1	—	—
Antimony	2	507	9/19/00	NF	1	0	—	[0.663]	—	—	—	—
Arsenic	2	507	9/19/00	F	1	0	—	[3.4]	50	0/1	100	0/1
Arsenic	2	507	9/19/00	NF	1	0	—	[3.4]	—	—	—	—
Barium	2	507	9/19/00	F	1	1	16	—	2000	0/1	1000	0/1
Barium	2	507	9/19/00	NF	1	1	16	—	—	—	—	—
Beryllium	2	507	9/19/00	F	1	0	—	[0.01]	4	0/1	—	—
Beryllium	2	507	9/19/00	NF	1	0	—	[0.01]	—	—	—	—
Boron	2	507	9/19/00	F	1	0	—	[38]	—	—	750	0/1
Boron	2	507	9/19/00	NF	1	0	—	[42]	—	—	—	—

Table A-2 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Frequency of Detects > Drinking Water MCL ^b (µg/L)	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Bromide	2	507	9/19/00	F	1	0	—	[200]	—	—	—
Bromide	2	507	9/19/00	NF	1	0	—	[200]	—	—	—
Cadmium	2	507	9/19/00	F	1	0	—	[0.13]	5	0/1	0/1
Cadmium	2	507	9/19/00	NF	1	0	—	[0.13]	—	—	—
Calcium	2	507	9/19/00	F	1	1	15000	—	—	—	—
Calcium	2	507	9/19/00	NF	1	1	15000	—	—	—	—
Chloride	2	507	9/19/00	F	1	1	6700	—	250000	0/1	250000 0/1
Chloride	2	507	9/19/00	NF	1	1	6600	—	—	—	—
Chromium	2	507	9/19/00	F	1	0	—	[0.33]	100	0/1	50 0/1
Chromium	2	507	9/19/00	NF	1	0	—	[0.33]	—	—	—
Cobalt	2	507	9/19/00	F	1	1	0.34	—	—	—	50 0/1
Cobalt	2	507	9/19/00	NF	1	0	—	[0.3]	—	—	—
Copper	2	507	9/19/00	F	1	0	—	[0.7]	1300	0/1	1000 0/1
Copper	2	507	9/19/00	NF	1	1	2.8	—	—	—	—
Cyanide (total)	2	507	9/19/00	NF	1	0	—	[10]	—	—	—
Fluoride	2	507	9/19/00	F	1	1	430	—	4000	0/1	1600 0/1
Fluoride	2	507	9/19/00	NF	1	1	430	—	—	—	—
Iron	2	507	9/19/00	F	1	0	—	[25]	300	0/1	1000 0/1
Iron	2	507	9/19/00	NF	1	0	—	[84]	—	—	—
Lead	2	507	9/19/00	F	1	0	—	[0.102]	15	0/1	50 0/1
Lead	2	507	9/19/00	NF	1	1	0.448	—	—	—	—
Magnesium	2	507	9/19/00	F	1	1	3000	—	—	—	—
Magnesium	2	507	9/19/00	NF	1	1	3000	—	—	50 1/1	200 0/1
Manganese	2	507	9/19/00	F	1	1	180	—	—	—	—
Manganese	2	507	9/19/00	NF	1	1	180	—	—	—	—
Mercury	2	507	9/19/00	F	1	0	—	[0.0092]	2	0/1	—
Mercury	2	507	9/19/00	NF	1	0	—	[0.0092]	—	2	0/1

Table A-2 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Frequency of Detects > Drinking Water MCL ^b	NMED Groundwater Standard ^c (µg/L)	Frequency of Detects > NMED Groundwater Standard
Molybdenum	2	507	9/19/00	F	1	1	11	—	—	—	—
Molybdenum	2	507	9/19/00	NF	1	1	12	—	—	—	—
Nickel	2	507	9/19/00	F	1	0	—	[1.7]	100	0/1	0/1
Nickel	2	507	9/19/00	NF	1	0	—	[2.1]	—	—	—
Nitrate + Nitrite (as N)	2	507	9/19/00	F	1	1	130	—	10000	0/1	—
Nitrate + Nitrite (as N)	2	507	9/19/00	NF	1	0	—	[100]	—	—	—
Perchlorate	2	507	9/19/00	F	1	0	—	[1.04]	—	—	—
Perchlorate	2	507	9/19/00	NF	1	0	—	[1.04]	—	—	—
Phosphorus (total)	2	507	9/19/00	F	1	1	293.4	—	—	—	—
Phosphorus (total)	2	507	9/19/00	NF	1	1	32.6	—	—	—	—
Potassium	2	507	9/19/00	F	1	1	2100	—	—	—	—
Potassium	2	507	9/19/00	NF	1	1	2100	—	—	—	—
Selenium	2	507	9/19/00	F	1	0	—	[2.6]	50	0/1	50/0/1
Selenium	2	507	9/19/00	NF	1	0	—	[2.6]	—	—	—
Silica	2	507	9/19/00	F	1	1	29820	—	—	—	—
Silica	2	507	9/19/00	NF	1	1	29820	—	—	—	—
Silver	2	507	9/19/00	F	1	0	—	[0.45]	100	0/1	50/0/1
Silver	2	507	9/19/00	NF	1	0	—	[0.45]	—	—	—
Sodium	2	507	9/19/00	F	1	1	9400	—	—	—	—
Sodium	2	507	9/19/00	NF	1	1	9500	—	—	—	—
Strontrium	2	507	9/19/00	NF	1	1	68	—	—	—	—
Strontrium	2	507	9/19/00	F	1	1	68	—	—	—	—
Sulfate	2	507	9/19/00	F	1	1	7700	—	250000	0/1	600000/0/1
Sulfate	2	507	9/19/00	NF	1	1	7400	—	—	—	—
Thallium	2	507	9/19/00	F	1	0	—	[0.166]	2	0/1	—
Thallium	2	507	9/19/00	NF	1	1	0.486	—	—	—	—
Total Kjeldahl Nitrogen	2	507	9/19/00	F	1	1	570	—	—	—	—

Table A-2 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detect Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Total Kjeldahl Nitrogen	2	507	9/19/00	NF	1	1	470	—	—	—	—	—
Uranium by ICPMS ⁱ	2	507	9/19/00	F	1	1	0.463	—	—	—	—	—
Uranium by ICPMS	2	507	9/19/00	NF	1	1	0.507	—	—	—	—	—
Uranium by KPA ^j	2	507	9/19/00	F	1	1	0.43	—	—	—	—	—
Uranium by KPA	2	507	9/19/00	NF	1	1	0.52	—	—	—	—	—
Vanadium	2	507	9/19/00	F	1	1	0.48	—	—	—	—	—
Vanadium	2	507	9/19/00	NF	1	1	0.87	—	—	—	—	—
Zinc	2	507	9/19/00	F	1	0	—	[1]	5000	0/1	10000	0/1
Zinc	2	507	9/19/00	NF	1	0	—	[7.8]	—	—	—	—
Stable Isotope (‰)												
δD	2	507	9/19/00	NF	1	1	-85	—	—	—	—	—
$\delta^{15}\text{N} - \text{NH}_4$	2	507	9/19/00	NF	1	1	ISV ^k	—	—	—	—	—
$\delta^{15}\text{N} - \text{NO}_3$	2	507	9/19/00	NF	1	1	-3.7	—	—	—	—	—
$\delta^{18}\text{O}$	2	507	9/19/00	NF	1	1	-11.5	—	—	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.^c NMED = New Mexico Environment Department.^d State of New Mexico groundwater standards are from *New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection*, 20 NMAC 6.2.^e NF = Nonfiltered.^f — = Not available or not applicable.^g NTU = Nephelometric turbidity unit.^h F = Filtered.ⁱ ICPMS = Inductively coupled plasma mass spectrometry.^j KPA = Kinetic phosphorescence analysis.^k ISV = Insufficient sample volume.

Table A-3
Regional Well R-12 Screen 3 First Round Sample Results: Data Summary for Inorganic Chemicals

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMEDC Groundwater Standard ^c (µg/L)	Frequency of Detects > NMED Groundwater Standard
Field Parameter												
Field Alkalinity (total as CaCO ₃)	3	811	9/20/00	NF ^e	1	0	— ^f	—	—	—	—	—
pH	3	811	9/20/00	NF	1	1	7.24	—	—	>6 & <9	0/1	>6 & <9
Specific Conductance (µS/cm)	3	811	9/20/00	NF	1	1	300	—	—	0/1	—	0/1
Temperature (°C)	3	811	9/20/00	NF	1	1	22.5	—	—	0/1	—	0/1
Turbidity (NTU ^g)	3	811	9/20/00	NF	1	1	6.8	—	—	0/1	—	0/1
Analyte												
Lab Alkalinity (total as CaCO ₃)	3	811	9/20/00	F	1	1	170000	—	—	—	—	—
Lab Alkalinity (total as CaCO ₃)	3	811	9/20/00	NF	1	1	160000	—	—	—	—	—
Aluminum	3	811	9/20/00	F ^h	1	0	—	[7.9]	50	0/1	5000	0/1
Aluminum	3	811	9/20/00	NF	1	0	—	[7.9]	—	—	—	—
Ammonia (as N)	3	811	9/20/00	F	1	0	—	[500]	—	—	—	—
Ammonia (as N)	3	811	9/20/00	NF	1	0	—	[500]	—	—	—	—
Antimony	3	811	9/20/00	F	1	0	—	[0.663]	6	0/1	—	—
Antimony	3	811	9/20/00	NF	1	0	—	[0.663]	—	—	—	—
Arsenic	3	811	9/20/00	F	1	0	—	[3.4]	50	0/1	100	0/1
Arsenic	3	811	9/20/00	NF	1	0	—	[3.4]	—	—	—	—
Barium	3	811	9/20/00	F	1	1	110	—	2000	0/1	1000	0/1
Barium	3	811	9/20/00	NF	1	1	110	—	—	—	—	—
Beryllium	3	811	9/20/00	F	1	0	—	[0.01]	4	0/1	—	—
Beryllium	3	811	9/20/00	NF	1	0	—	[0.01]	—	—	—	—
Boron	3	811	9/20/00	F	1	1	110	—	—	—	750	0/1
Boron	3	811	9/20/00	NF	1	1	100	—	—	—	—	—

Table A-3 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Frequency of Detects > Drinking Water MCL ^b (µg/L)	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Bromide	3	811	9/20/00	F	1	0	—	[200]	—	—	—
Bromide	3	811	9/20/00	NF	1	0	—	[200]	—	—	—
Cadmium	3	811	9/20/00	F	1	0	—	[0.13]	5	0/1	0/1
Cadmium	3	811	9/20/00	NF	1	0	—	[0.13]	—	—	—
Calcium	3	811	9/20/00	F	1	1	41000	—	—	—	—
Calcium	3	811	9/20/00	NF	1	1	40000	—	—	—	—
Chloride	3	811	9/20/00	F	1	1	10000	—	250000	0/1	250000 0/1
Chloride	3	811	9/20/00	NF	1	1	10000	—	—	—	—
Chromium	3	811	9/20/00	F	1	0	—	[0.33]	100	0/1	50 0/1
Chromium	3	811	9/20/00	NF	1	1	2.1	—	—	—	—
Cobalt	3	811	9/20/00	F	1	1	3.1	—	—	—	—
Cobalt	3	811	9/20/00	NF	1	1	2.6	—	—	—	—
Copper	3	811	9/20/00	F	1	0	—	[0.46]	1300	0/1	1000 0/1
Copper	3	811	9/20/00	NF	1	0	—	[1.1]	—	—	—
Cyanide (total)	3	811	9/20/00	NF	1	0	—	[10]	—	—	—
Fluoride	3	811	9/20/00	F	1	1	270	—	4000	0/1	1600 0/1
Fluoride	3	811	9/20/00	NF	1	1	270	—	—	—	—
Iron	3	811	9/20/00	F	1	1	740	—	300	1/1	1000 0/1
Iron	3	811	9/20/00	NF	1	1	1100	—	—	—	—
Lead	3	811	9/20/00	F	1	0	—	[0.01]	15	0/1	50 0/1
Lead	3	811	9/20/00	NF	1	0	—	[0.01]	—	—	—
Magnesium	3	811	9/20/00	F	1	1	9900	—	—	—	—
Magnesium	3	811	9/20/00	NF	1	1	9700	—	—	—	—
Manganese	3	811	9/20/00	F	1	1	1100	—	50	1/1	200 1/1
Manganese	3	811	9/20/00	NF	1	1	1100	—	—	—	—
Mercury	3	811	9/20/00	F	1	0	—	[0.0092]	2	0/1	—
Mercury	3	811	9/20/00	NF	1	0	—	[0.0092]	—	2	0/1

Table A-3 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Frequency of Detects > Drinking Water MCL ^b (µg/L)	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Molybdenum	3	811	9/20/00	F	1	1	8.3	—	—	—	—
Molybdenum	3	811	9/20/00	NF	1	1	11	—	—	—	—
Nickel	3	811	9/20/00	F	1	1	49	—	100	0/1	200
Nickel	3	811	9/20/00	NF	1	1	53	—	—	—	—
Nitrate + Nitrite (as N)	3	811	9/20/00	F	1	0	—	[100]	10000	0/1	—
Nitrate + Nitrite (as N)	3	811	9/20/00	NF	1	0	—	[100]	—	—	—
Perchlorate	3	811	9/20/00	F	1	0	—	[1.04]	—	—	—
Perchlorate	3	811	9/20/00	NF	1	0	—	[1.04]	—	—	—
Phosphorus (total)	3	811	9/20/00	F	1	0	—	[50]	—	—	—
Phosphorus (total)	3	811	9/20/00	NF	1	0	—	[50]	—	—	—
Potassium	3	811	9/20/00	F	1	1	4400	—	—	—	—
Potassium	3	811	9/20/00	NF	1	1	4300	—	—	—	—
Selenium	3	811	9/20/00	F	1	0	—	[2.6]	50	0/1	50
Selenium	3	811	9/20/00	NF	1	0	—	[2.6]	—	—	—
Silica	3	811	9/20/00	NF	1	1	55380	—	—	—	—
Silica	3	811	9/20/00	F	1	1	55380	—	—	—	—
Silver	3	811	9/20/00	F	1	0	—	[0.45]	100	0/1	50
Silver	3	811	9/20/00	NF	1	0	—	[0.45]	—	—	—
Sodium	3	811	9/20/00	F	1	1	18000	—	—	—	—
Sodium	3	811	9/20/00	NF	1	1	18000	—	—	—	—
Strontrium	3	811	9/20/00	F	1	1	210	—	—	—	—
Strontrium	3	811	9/20/00	NF	1	1	200	—	—	—	—
Sulfate	3	811	9/20/00	F	1	1	16000	—	250000	0/1	600000
Sulfate	3	811	9/20/00	NF	1	1	16000	—	—	—	—
Thallium	3	811	9/20/00	F	1	0	—	[0.026]	2	0/1	—
Thallium	3	811	9/20/00	NF	1	0	—	[0.026]	—	—	—

Table A-3 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detect Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Total Kjeldahl Nitrogen	3	811	9/20/00	F	1	1	250	—	—	—	—	—
Total Kjeldahl Nitrogen	3	811	9/20/00	NF	1	1	280	—	—	—	—	—
Uranium by ICPMS ^e	3	811	9/20/00	F	1	1	0.333	—	—	—	—	—
Uranium by ICPMS	3	811	9/20/00	NF	1	1	0.896	—	—	—	—	—
Uranium by KPA ^f	3	811	9/20/00	F	1	1	0.31	—	—	—	—	—
Uranium by KPA	3	811	9/20/00	NF	1	1	0.81	—	—	—	—	—
Vanadium	3	811	9/20/00	F	1	1	1.7	—	—	—	—	—
Vanadium	3	811	9/20/00	NF	1	1	1	—	—	—	—	—
Zinc	3	811	9/20/00	F	1	0	—	[22]	5000	0/1	10000	0/1
Zinc	3	811	9/20/00	NF	1	0	—	[9.7]	—	—	—	—
Stable Isotope (%)												
δD	3	811	9/20/00	NF	1	1	-81	—	—	—	—	—
δ ¹⁵ N – NH ₄	3	811	9/20/00	NF	1	1	ISV ^g	—	—	—	—	—
δ ¹⁵ N – NO ₃	3	811	9/20/00	NF	1	1	ISV	—	—	—	—	—
δ ¹⁸ O	3	811	9/20/00	NF	1	1	-11.3	—	—	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.^c NMED = New Mexico Environment Department.^d State of New Mexico groundwater standards are from *New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection*, 20 NMAC 6.2.^e NF = Nonfiltered.^f — = Not available or not applicable.^g NTU = Nephelometric turbidity unit.^h F = Filtered.ⁱ ICPMS = Inductively coupled plasma mass spectrometry.^j KPA = Kinetic phosphorescence analysis.^k ISV = Insufficient sample volume.

Table A-4
Regional Well R-12 Screen 1 First Round Sample Results: Data Summary for Detected Organic Chemicals

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Bis(2-ethylhexyl)phthalate	1	468	9/18/00	NF ^e	1	1	3.2	6	0/1	— ^f	—
Total Organic Carbon	1	468	9/18/00	NF	1	1	7700	—	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.

^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.

^c NMED = New Mexico Environment Department.

^d State of New Mexico groundwater standards are from *New Mexico Water Quality Control Commission Regulations*, *Ground and Surface Water Protection*, 20 NMAC 6.2.

^e NF = Nonfiltered.

^f — = Not available or not applicable.

Table A-5
Regional Well R-12 Screen 2 First Round Sample Results: Data Summary for Detected Organic Chemicals

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Carbon Disulfide	2	507	9/19/00	NF ^e	1	1	1.7	— ^f	—	—	—
Total Organic Carbon	2	507	9/19/00	NF	1	1	16000	—	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.

^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.

^c NMED = New Mexico Environment Department.

^d State of New Mexico groundwater standards are from *New Mexico Water Quality Control Commission Regulations*, *Ground and Surface Water Protection*, 20 NMAC 6.2.

^e NF = Nonfiltered.

^f — = Not available or not applicable.

Table A-6
Regional Well R-12 Screen 3 First Round Sample Results: Data Summary for Detected Organic Chemicals

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Total Organic Carbon	3	811	9/20/00	NF ^e	1	1	45000	— ^f	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.

^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.

^c NMED = New Mexico Environment Department.

^d State of New Mexico groundwater standards are from *New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection*, 20 NMAC 6.2.

^e NF = Nonfiltered.

^f — = Not available or not applicable.

Table A-7
Regional Well R-12 Screen 1 First Round Sample Results: Data Summary for Radionuclides

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (pCi/L)	Nondetected Value (pCi/L)	Drinking Water MCL ^b (pCi/L)	Frequency of Detects > Drinking Water MCL
Americium-241	1	468	9/18/00	F ^c	1	0	— ^d	[0.00255]	15 ^e	0/1
Americium-241	1	468	9/18/00	NF ^f	1	0	—	[0.000282]	—	—
Gross Alpha Radiation	1	468	9/18/00	F	1	0	—	[0.921]	15	0/1
Gross Alpha Radiation	1	468	9/18/00	NF	1	0	—	[0.884]	—	—
Gross Beta Radiation	1	468	9/18/00	F	1	1	5.23	—	—	—
Gross Beta Radiation	1	468	9/18/00	NF	1	1	6.35	—	—	—
Plutonium-238	1	468	9/18/00	F	1	0	—	[<0.00159]	15 ^e	0/1
Plutonium-238	1	468	9/18/00	NF	1	0	—	[0.000406]	—	—
Plutonium-239	1	468	9/18/00	F	1	0	—	[0.00397]	15 ^e	0/1
Plutonium-239	1	468	9/18/00	NF	1	0	—	[0.00202]	—	—
Strontrium-90	1	468	9/18/00	F	1	0	—	[0.178]	8	0/1
Strontrium-90	1	468	9/18/00	NF	1	0	—	[0.494]	—	—
Tritium	1	468	9/18/00	NF	1	1	192	—	20000	0/1
Uranium-234	1	468	9/18/00	F	1	1	0.399	—	—	—
Uranium-234	1	468	9/18/00	NF	1	1	0.431	—	—	—
Uranium-235	1	468	9/18/00	F	1	0	—	[0.00765]	—	—
Uranium-235	1	468	9/18/00	NF	1	0	—	[0.0173]	—	—
Uranium-238	1	468	9/18/00	F	1	1	0.248	—	—	—
Uranium-238	1	468	9/18/00	NF	1	1	0.26	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.

^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from National Primary Drinking Water Regulations, 40 CFR Part 141. US EPA secondary MCLs are from National Secondary Drinking Water Regulations, 40 CFR Part 143. State of New Mexico MCLs are from Drinking Water Regulations, 20 NMAC 7.1.

^c F = Filtered.

^d — = Not available or not applicable.

^e Based on an MCL of 15 pCi/L (including radium-226, but excluding radon and uranium).

^f NF = Nonfiltered.

Table A-8
Regional Well R-12 Screen 2 First Round Sample Results: Data Summary for Radionuclides

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (pCi/L)	Nondetected Value (pCi/L)	Drinking Water MCL ^b (pCi/L)	Frequency of Detects > Drinking Water MCL
Americium-241	2	507	09/19/00	F ^c	1	0	— ^d	[0.013]	15 ^e	0/1
Americium-241	2	507	09/19/00	NF ^f	1	0	—	[0.031]	—	—
Cesium-134	2	507	09/19/00	F	1	0	—	[1.2]	—	—
Cesium-134	2	507	09/19/00	NF	1	0	—	[0.2]	—	—
Cesium-137	2	507	09/19/00	F	1	0	—	[1.3]	—	—
Cesium-137	2	507	09/19/00	NF	1	0	—	[0.3]	—	—
Cobalt-60	2	507	09/19/00	F	1	0	—	[0.1]	—	—
Cobalt-60	2	507	09/19/00	NF	1	0	—	[2.5]	—	—
Europium-152	2	507	09/19/00	F	1	0	—	[0.6]	—	—
Europium-152	2	507	09/19/00	NF	1	0	—	[3.8]	—	—
Gross Alpha Radiation	2	507	09/19/00	F	1	0	—	[0.5]	15 ^e	0/1
Gross Alpha Radiation	2	507	09/19/00	NF	1	0	—	[0.8]	—	—
Gross Beta Radiation	2	507	09/19/00	F	1	0	—	[1.9]	—	—
Gross Beta Radiation	2	507	09/19/00	NF	1	0	—	[1.6]	—	—
Gross Gamma Radiation	2	507	09/19/00	F	1	1	303	—	—	—
Gross Gamma Radiation	2	507	09/19/00	NF	1	1	469	—	—	—
Plutonium-238	2	507	09/19/00	F	1	0	—	[0.006]	15 ^e	0/1
Plutonium-238	2	507	09/19/00	NF	1	0	—	[0.005]	—	—
Plutonium-239	2	507	09/19/00	F	1	0	—	[0.017]	15 ^e	0/1
Plutonium-239	2	507	09/19/00	NF	1	0	—	[0.003]	—	—
Ruthenium-106	2	507	09/19/00	F	1	0	—	[15]	—	—
Ruthenium-106	2	507	09/19/00	NF	1	0	—	[4]	—	—
Srtronium-90	2	507	09/19/00	F	1	0	—	[0.02]	8	0/1
Srtronium-90	2	507	09/19/00	NF	1	0	—	[0.06]	—	—
Tritium	2	507	09/19/00	NF	1	1	96.08	—	20000	0/1
Uranium-234	2	507	09/19/00	F	1	1	0.363	—	—	—
Uranium-234	2	507	09/19/00	NF	1	1	0.311	—	—	—

Table A-8 (continued)

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (pCi/L)	Nondetected Value (pCi/L)	Drinking Water MCL ^b (pCi/L)	Frequency of Detects > Drinking Water MCL
Uranium-235	2	507	09/19/00	F	1	0	—	[0.06]	—	—
Uranium-235	2	507	09/19/00	NF	1	0	—	[0.066]	—	—
Uranium-238	2	507	09/19/00	F	1	1	0.225	—	—	—
Uranium-238	2	507	09/19/00	NF	1	1	0.207	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.

^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.

^c F = Filtered.

^d — = Not available or not applicable.

^e Based on an MCL of 15 pCi/L (including radium-226, but excluding radon and uranium).

^f NF = Nonfiltered.

Table A-9
Regional Well R-12 Screen 3 First Round Sample Results: Data Summary for Radionuclides

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (pCi/L)	Nondetected Value (pCi/L)	Drinking Water MCL ^b (pCi/L)	Frequency of Detects > Drinking Water MCL
Americium-241	3	811	9/20/00	F ^c	1	0	— ^d	[0.012]	15 ^e	0/1
Americium-241	3	811	9/20/00	NF ^f	1	0	—	[0.027]	—	—
Cesium-134	3	811	9/20/00	F	1	0	—	[-0.2]	—	—
Cesium-134	3	811	9/20/00	NF	1	0	—	[0.3]	—	—
Cesium-137	3	811	9/20/00	F	1	0	—	[-0.7]	—	—
Cesium-137	3	811	9/20/00	NF	1	0	—	[-0.7]	—	—
Cobalt-60	3	811	9/20/00	F	1	0	—	[-0.2]	—	—
Cobalt-60	3	811	9/20/00	NF	1	0	—	[0.6]	—	—
Europium-152	3	811	9/20/00	F	1	0	—	[1.7]	—	—
Europium-152	3	811	9/20/00	NF	1	0	—	[1.1]	—	—
Gross Alpha Radiation	3	811	9/20/00	F	1	0	—	[1.2]	15	0/1
Gross Alpha Radiation	3	811	9/20/00	NF	1	0	—	[-0.21]	—	—
Gross Beta Radiation	3	811	9/20/00	F	1	1	4.9	—	—	—
Gross Beta Radiation	3	811	9/20/00	NF	1	1	3.8	—	—	—
Gross Gamma Radiation	3	811	9/20/00	F	1	0	—	[346]	—	—
Gross Gamma Radiation	3	811	9/20/00	NF	1	0	—	[330]	—	—
Neptunium-237	3	811	9/20/00	F	1	0	—	[-3]	—	—
Neptunium-237	3	811	9/20/00	NF	1	0	—	[5]	—	—
Plutonium-238	3	811	9/20/00	F	1	0	—	[0.033]	15 ^e	0/1
Plutonium-238	3	811	9/20/00	NF	1	0	—	[-0.007]	—	—
Plutonium-239	3	811	9/20/00	F	1	0	—	[0.006]	15 ^e	0/1
Plutonium-239	3	811	9/20/00	NF	1	0	—	[0]	—	—
Ruthenium-106	3	811	9/20/00	F	1	0	—	[5]	—	—
Ruthenium-106	3	811	9/20/00	NF	1	0	—	[0]	—	—
Sodium-22	3	811	9/20/00	NF	1	0	—	[-0.4]	—	—
Sodium-22	3	811	9/20/00	F	1	0	—	[-0.8]	—	—
Strontrium-90	3	811	9/20/00	F	1	0	—	[0.25]	8	0/1

Table A-9 (continued)

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (pCi/L)	Nondetected Value (pCi/L)	Drinking Water MCL ^b (pCi/L)	Frequency of Detects > Drinking Water MCL
Strontium-90	3	811	9/20/00	NF	1	0	—	[0.11]	—	—
Tritium	3	811	9/20/00	NF	1	1	82.7	—	20000	0/1
Uranium-234	3	811	9/20/00	F	1	1	0.236	—	—	—
Uranium-234	3	811	9/20/00	NF	1	1	0.261	—	—	—
Uranium-235	3	811	9/20/00	F	1	0	—	[0.055]	—	—
Uranium-235	3	811	9/20/00	NF	1	0	—	[0.043]	—	—
Uranium-238	3	811	9/20/00	F	1	1	0.108	—	—	—
Uranium-238	3	811	9/20/00	NF	1	1	0.163	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.^c F = Filtered.^d — = Not available or not applicable.^e Based on an MCL of 15 pCi/L (including radium-226, but excluding radon and uranium).^f NF = Nonfiltered.

Table A-10
Regional Well R-12 Screen 1 Second Round Sample Results: Data Summary for Inorganic Chemicals

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMEDC Groundwater Standard ^c (µg/L)	Frequency of Detects > NMEDC Groundwater Standard
Field Parameter												
Field Alkalinity (total as CaCO ₃)	1	468	03/14/01	NF ^e	1	0	— ^f	—	—	—	—	—
pH	1	468	03/14/01	NF	1	1	6.91	—	>6 & <9	0/1	>6 & <9	0/1
Specific Conductance (µS/cm)	1	468	03/14/01	NF	1	1	254	—	—	0/1	—	0/1
Temperature (°C)	1	468	03/14/01	NF	1	1	13.2	—	—	0/1	—	0/1
Turbidity (NTU ^g)	1	468	03/14/01	NF	1	1	4.4	—	—	0/1	—	0/1
Analyte												
Lab Alkalinity (total as CaCO ₃)	1	468	03/14/01	Fh	1	1	120000	—	—	—	—	—
Aluminum	1	468	03/14/01	F	1	0	—	[7.7]	50	0/1	5000	0/1
Aluminum	1	468	03/14/01	NF	1	0	—	[7.7]	—	—	—	—
Ammonia (as N)	1	468	03/14/01	F	1	1	1600	—	—	—	—	—
Antimony	1	468	03/14/01	F	1	0	—	[0.153]	6	0/1	—	—
Antimony	1	468	03/14/01	NF	1	0	—	[0.153]	—	—	—	—
Arsenic	1	468	03/14/01	F	1	0	—	[1.5]	50	0/1	100	0/1
Arsenic	1	468	03/14/01	NF	1	0	—	[1.5]	—	—	—	—
Barium	1	468	03/14/01	F	1	1	48	—	2000	0/1	1000	0/1
Barium	1	468	03/14/01	NF	1	1	51	—	—	—	—	—
Beryllium	1	468	03/14/01	F	1	0	—	[0.002]	4	0/1	—	—
Beryllium	1	468	03/14/01	NF	1	0	—	[0.01]	—	—	—	—
Boron	1	468	03/14/01	F	1	0	—	[110]	—	—	750	0/1
Boron	1	468	03/14/01	NF	1	0	—	[110]	—	—	—	—
Bromide	1	468	03/14/01	F	1	0	—	[200]	—	—	—	—
Cadmium	1	468	03/14/01	F	1	0	—	[0.2]	5	0/1	10	0/1
Cadmium	1	468	03/14/01	NF	1	0	—	[0.2]	—	—	—	—

Table A-10 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Frequency of Detects > Drinking Water MCL ^b (µg/L)	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Calcium	1	468	03/14/01	F	1	1	15000	—	—	—	—
Calcium	1	468	03/14/01	NF	1	1	16000	—	—	—	—
Chloride	1	468	03/14/01	F	1	1	13000	—	250000	0/1	250000
Chromium (total)	1	468	03/14/01	F	1	0	—	[0.34]	100	0/1	50
Chromium (total)	1	468	03/14/01	NF	1	0	—	[0.34]	—	—	—
Cobalt	1	468	03/14/01	F	1	0	—	[0.4]	—	—	50
Cobalt	1	468	03/14/01	NF	1	0	—	[0.4]	—	—	—
Copper	1	468	03/14/01	F	1	1	0.45	—	1300	0/1	1000
Copper	1	468	03/14/01	NF	1	1	3	—	—	—	—
Cyanide (total)	1	468	03/14/01	NF	1	0	—	[10]	—	—	—
Fluoride	1	468	03/14/01	F	1	1	680	—	4000	0/1	1600
Iron	1	468	03/14/01	F	1	1	600	—	300	1/1	1000
Iron	1	468	03/14/01	NF	1	1	1400	—	—	—	—
Lead	1	468	03/14/01	F	1	0	—	[0.65]	15	0/1	50
Lead	1	468	03/14/01	NF	1	1	1.4	—	—	—	—
Magnesium	1	468	03/14/01	F	1	1	4300	—	—	—	—
Magnesium	1	468	03/14/01	NF	1	1	4400	—	—	—	—
Manganese	1	468	03/14/01	F	1	1	720	—	50	1/1	200
Manganese	1	468	03/14/01	NF	1	1	720	—	—	—	—
Mercury	1	468	03/14/01	F	1	0	—	[0.016]	2	0/1	—
Mercury	1	468	03/14/01	NF	1	0	—	[0.016]	—	—	2
Molybdenum	1	468	03/14/01	F	1	1	2.8	—	—	—	—
Molybdenum	1	468	03/14/01	NF	1	1	29	—	—	—	—
Nickel	1	468	03/14/01	F	1	1	0.91	—	100	0/1	200
Nickel	1	468	03/14/01	NF	1	1	1.1	—	—	—	—
Nitrate + Nitrite (as N)	1	468	03/14/01	F	1	1	230	—	10000	0/1	—
Perchlorate	1	468	03/14/01	F	1	0	—	[0.958]	—	—	—

Table A-10 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Frequency of Detects > Drinking Water MCL ^b (µg/L)	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Phosphorus (total)	1	468	03/14/01	F	1	0	—	[50]	—	—	—
Potassium	1	468	03/14/01	F	1	1	3300	—	—	—	—
Potassium	1	468	03/14/01	NF	1	1	3400	—	—	—	—
Selenium	1	468	03/14/01	F	1	0	—	[2.5]	50	0/1	0/1
Selenium	1	468	03/14/01	NF	1	0	—	[2.5]	—	—	—
Silica	1	468	03/14/01	F	1	1	41674	—	—	—	—
Silica	1	468	03/14/01	NF	1	1	43506	—	—	—	—
Silver	1	468	03/14/01	F	1	1	0.85	—	100	0/1	50
Silver	1	468	03/14/01	NF	1	1	1.3	—	—	—	—
Sodium	1	468	03/14/01	F	1	1	23000	—	—	—	—
Sodium	1	468	03/14/01	NF	1	1	23000	—	—	—	—
Strontrium	1	468	03/14/01	F	1	1	71	—	—	—	—
Strontrium	1	468	03/14/01	NF	1	1	73	—	—	—	—
Sulfate	1	468	03/14/01	F	1	0	—	[1000]	250000	0/1	600000
Thallium	1	468	03/14/01	F	1	0	—	[0.077]	2	0/1	—
Thallium	1	468	03/14/01	NF	1	0	—	[0.077]	—	—	—
Total Kjeldahl Nitrogen	1	468	03/14/01	F	1	1	2100	—	—	—	—
Uranium	1	468	03/14/01	F	1	1	0.055	—	20	0/1	5000
Uranium	1	468	03/14/01	NF	1	1	0.08	—	—	—	—
Vanadium	1	468	03/14/01	F	1	0	—	[0.38]	—	—	—
Vanadium	1	468	03/14/01	NF	1	0	—	[0.38]	—	—	—
Zinc	1	468	03/14/01	F	1	1	1.6	—	5000	0/1	10000
Zinc	1	468	03/14/01	NF	1	1	16	—	—	—	—

Table A-10 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Stable Isotope (%)											
δD	1	468	03/14/01	NF	1	1	-81	—	—	—	—
$\delta^{15}\text{N} - \text{NH}_4$	1	468	03/14/01	NF	1	1	-0.8	—	—	—	—
$\delta^{15}\text{N} - \text{NO}_3$	1	468	03/14/01	NF	1	1	SV ⁱ	—	—	—	—
$\delta^{18}\text{O}$	1	468	03/14/01	NF	1	1	-11.7	—	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.^c NMED = New Mexico Environment Department.^d State of New Mexico groundwater standards are from *New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection*, 20 NMAC 6.2.^e NF = Nonfiltered.^f — = Not available or not applicable.^g NTU = Nephelometric turbidity unit.^h F = Filtered.ⁱ ISV = Insufficient sample volume.

**Table A-11
Regional Well R-12 Screen 2 Second Round Sample Results: Data Summary for Inorganic Chemicals**

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Field Parameter												
Field Alkalinity (total as CaCO ₃)	2	507	03/15/01	NF ^e	1	0	— ^f	—	—	—	—	—
pH	2	507	03/15/01	NF	1	1	9.08	—	>6 & <9	0/1	>6 & <9	0/1
Specific Conductance (µS/cm)	2	507	03/15/01	NF	1	1	155	—	—	0/1	—	0/1
Temperature (°C)	2	507	03/15/01	NF	1	1	17.1	—	—	0/1	—	0/1
Turbidity (NTU ^g)	2	507	03/15/01	NF	1	1	2.3	—	—	0/1	—	0/1
Analyte												
Lab Alkalinity (total as CaCO ₃)	2	507	03/15/01	Fh	1	1	67000	—	—	—	—	—
Aluminum	2	507	03/15/01	F	1	1	12	—	50	0/1	5000	0/1
Aluminum	2	507	03/15/01	NF	1	1	16	—	—	—	—	—
Ammonia (as N)	2	507	03/15/01	F	1	0	—	[500]	—	—	—	—
Antimony	2	507	03/15/01	F	1	0	—	[0.293]	6	0/1	—	—
Antimony	2	507	03/15/01	NF	1	0	—	[0.299]	—	—	—	—
Arsenic	2	507	03/15/01	F	1	0	—	[1.5]	50	0/1	100	0/1
Arsenic	2	507	03/15/01	NF	1	0	—	[1.5]	—	—	—	—
Barium	2	507	03/15/01	F	1	1	15	—	2000	0/1	1000	0/1
Barium	2	507	03/15/01	NF	1	1	14	—	—	—	—	—
Beryllium	2	507	03/15/01	F	1	1	0.066	—	4	0/1	—	—
Beryllium	2	507	03/15/01	NF	1	1	0.102	—	—	—	—	—
Boron	2	507	03/15/01	F	1	1	37	—	—	—	750	0/1
Boron	2	507	03/15/01	NF	1	1	33	—	—	—	—	—
Bromide	2	507	03/15/01	F	1	0	—	[200]	—	—	—	—
Cadmium	2	507	03/15/01	F	1	0	—	[0.066]	5	0/1	10	0/1
Cadmium	2	507	03/15/01	NF	1	0	—	[0.066]	—	—	—	—

Table A-11 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Frequency of Detects > Drinking Water MCL ^b (µg/L)	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Calcium	2	507	03/15/01	F	1	1	15000	—	—	—	—
Calcium	2	507	03/15/01	NF	1	1	15000	—	—	—	—
Chloride	2	507	03/15/01	F	1	1	6700	—	250000	0/1	250000
Chromium (total)	2	507	03/15/01	F	1	0	—	[0.34]	100	0/1	50
Chromium (total)	2	507	03/15/01	NF	1	1	3.7	—	—	—	—
Cobalt	2	507	03/15/01	F	1	0	—	[0.4]	—	—	50
Cobalt	2	507	03/15/01	NF	1	0	—	[0.4]	—	—	—
Copper	2	507	03/15/01	F	1	0	—	[0.34]	1300	0/1	1000
Copper	2	507	03/15/01	NF	1	1	0.66	—	—	—	—
Cyanide (total)	2	507	03/15/01	NF	1	1	14	—	—	—	—
Fluoride	2	507	03/15/01	F	1	1	490	—	4000	0/1	1600
Iron	2	507	03/15/01	F	1	0	—	[54]	300	0/1	1000
Iron	2	507	03/15/01	NF	1	0	—	[67]	—	—	—
Lead	2	507	03/15/01	F	1	1	0.465	—	15	0/1	50
Lead	2	507	03/15/01	NF	1	0	—	[0.152]	—	—	—
Magnesium	2	507	03/15/01	F	1	1	2500	—	—	—	—
Magnesium	2	507	03/15/01	NF	1	1	2500	—	—	—	—
Manganese	2	507	03/15/01	F	1	1	60	—	50	1/1	200
Manganese	2	507	03/15/01	NF	1	1	62	—	—	—	—
Mercury	2	507	03/15/01	F	1	0	—	[0.016]	2	0/1	—
Mercury	2	507	03/15/01	NF	1	0	—	[0.016]	—	—	2
Molybdenum	2	507	03/15/01	F	1	1	12	—	—	—	—
Molybdenum	2	507	03/15/01	NF	1	1	8.8	—	—	—	—
Nickel	2	507	03/15/01	F	1	1	0.76	—	100	0/1	200
Nickel	2	507	03/15/01	NF	1	3	—	—	—	—	—
Nitrate + Nitrite (as N)	2	507	03/15/01	F	1	0	—	[100]	10000	0/1	—
Perchlorate	2	507	03/15/01	F	1	0	—	[0.958]	—	—	—

Table A-11 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Frequency of Detects > Drinking Water MCL ^b (µg/L)	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Phosphorus (total)	2	507	03/15/01	F	1	1	72	—	—	—	—
Potassium	2	507	03/15/01	F	1	1	2200	—	—	—	—
Potassium	2	507	03/15/01	NF	1	1	2200	—	—	—	—
Selenium	2	507	03/15/01	F	1	0	—	[2.5]	50	0/1	0/1
Selenium	2	507	03/15/01	NF	1	0	—	[2.5]	—	—	—
Silica	2	507	03/15/01	F	1	1	29960	—	—	—	—
Silica	2	507	03/15/01	NF	1	1	29960	—	—	—	—
Silver	2	507	03/15/01	F	1	0	—	[0.48]	100	0/1	0/1
Silver	2	507	03/15/01	NF	1	0	—	[0.49]	—	—	—
Sodium	2	507	03/15/01	F	1	1	9400	—	—	—	—
Sodium	2	507	03/15/01	NF	1	1	9500	—	—	—	—
Strontrium	2	507	03/15/01	F	1	1	65	—	—	—	—
Strontrium	2	507	03/15/01	NF	1	1	65	—	—	—	—
Sulfate	2	507	03/15/01	F	1	1	8100	—	250000	0/1	600000
Thallium	2	507	03/15/01	F	1	1	0.542	—	2	0/1	—
Thallium	2	507	03/15/01	NF	1	0	—	[0.462]	—	—	—
Total Kjeldahl Nitrogen	2	507	03/15/01	F	1	1	690	—	—	—	—
Uranium	2	507	03/15/01	F	1	1	0.659	—	20	0/1	5000
Uranium	2	507	03/15/01	NF	1	1	0.638	—	—	—	—
Vanadium	2	507	03/15/01	F	1	1	1.9	—	—	—	—
Vanadium	2	507	03/15/01	NF	1	1	0.94	—	—	—	—
Zinc	2	507	03/15/01	F	1	0	—	[2.9]	5000	0/1	10000
Zinc	2	507	03/15/01	NF	1	0	—	[3.1]	—	—	—

Table A-11 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Stable Isotope (%)												
δD	2	507	03/15/01	NF	1	1	-80	—	—	—	—	—
$\delta^{15}\text{N} - \text{NH}_4$	2	507	03/15/01	NF	1	1	SV ⁱ	—	—	—	—	—
$\delta^{15}\text{N} - \text{NO}_3$	2	507	03/15/01	NF	1	1	+1.5	—	—	—	—	—
$\delta^{18}\text{O}$	2	507	03/15/01	NF	1	1	-11.6	—	—	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.^c NMED = New Mexico Environment Department.^d State of New Mexico groundwater standards are from *New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection*, 20 NMAC 6.2.^e NF = Nonfiltered.^f — = Not available or not applicable.^g NTU = Nephelometric turbidity unit.^h F = Filtered.ⁱ ISV = Insufficient sample volume.

Table A-12
Regional Well R-12 Screen 3 Second Round Sample Results: Data Summary for Inorganic Chemicals

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMEDC Groundwater Standard ^c (µg/L)	Frequency of Detects > NMEDC Groundwater Standard
Field Parameter												
Field Alkalinity (total as CaCO ₃)	3	811	03/16/01	NF ^e	1	0	— ^f	—	—	—	—	—
pH	3	811	03/16/01	NF	1	1	6.83	—	>6.8<9	0/1	>6.8<9	0/1
Specific Conductance (µS/cm)	3	811	03/16/01	NF	1	1	389	—	—	0/1	—	0/1
Temperature (°C)	3	811	03/16/01	NF	1	1	19.9	—	—	0/1	—	0/1
Turbidity (NTU ^g)	3	811	03/16/01	NF	1	1	2.6	—	—	0/1	—	0/1
Analyte												
Lab Alkalinity (total as CaCO ₃)	3	811	03/16/01	Fh	1	1	180000	—	—	—	—	—
Aluminum	3	811	03/16/01	F	1	0	—	[7.7]	50	0/1	5000	0/1
Aluminum	3	811	03/16/01	NF	1	1	22	—	—	—	—	—
Ammonia (as N)	3	811	03/16/01	F	1	0	—	[500]	—	—	—	—
Antimony	3	811	03/16/01	F	1	0	—	[0.268]	6	0/1	—	—
Antimony	3	811	03/16/01	NF	1	0	—	[0.243]	—	—	—	—
Arsenic	3	811	03/16/01	F	1	0	—	[1.5]	50	0/1	100	0/1
Arsenic	3	811	03/16/01	NF	1	0	—	[1.5]	—	—	—	—
Barium	3	811	03/16/01	F	1	1	140	—	2000	0/1	1000	0/1
Barium	3	811	03/16/01	NF	1	1	140	—	—	—	—	—
Beryllium	3	811	03/16/01	F	1	1	0.019	—	4	0/1	—	—
Beryllium	3	811	03/16/01	NF	1	0	—	[0.021]	—	—	—	—
Boron	3	811	03/16/01	F	1	1	84	—	—	—	750	0/1
Boron	3	811	03/16/01	NF	1	1	76	—	—	—	—	—
Bromide	3	811	03/16/01	F	1	0	—	[200]	—	—	—	—
Cadmium	3	811	03/16/01	F	1	0	—	[0.066]	5	0/1	10	0/1
Cadmium	3	811	03/16/01	NF	1	0	—	[0.2]	—	—	—	—

Table A-12 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Frequency of Detects > Drinking Water MCL ^b (µg/L)	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Calcium	3	811	03/16/01	F	1	1	43000	—	—	—	—
Calcium	3	811	03/16/01	NF	1	1	44000	—	—	—	—
Chloride	3	811	03/16/01	F	1	1	9300	—	250000	0/1	250000
Chromium (total)	3	811	03/16/01	F	1	1	0.78	—	100	0/1	50
Chromium (total)	3	811	03/16/01	NF	1	1	9.3	—	—	—	—
Cobalt	3	811	03/16/01	F	1	1	0.93	—	—	—	50
Cobalt	3	811	03/16/01	NF	1	1	—	—	—	—	—
Copper	3	811	03/16/01	F	1	0	—	[0.34]	1300	0/1	1000
Copper	3	811	03/16/01	NF	1	0	—	[0.34]	—	—	—
Cyanide (total)	3	811	03/16/01	NF	1	0	—	[10]	—	—	—
Fluoride	3	811	03/16/01	F	1	1	320	—	4000	0/1	1600
Iron	3	811	03/16/01	F	1	1	270	—	300	0/1	1000
Iron	3	811	03/16/01	NF	1	1	460	—	—	—	—
Lead	3	811	03/16/01	F	1	0	—	[0.037]	15	0/1	50
Lead	3	811	03/16/01	NF	1	0	—	[0.65]	—	—	—
Magnesium	3	811	03/16/01	F	1	1	10000	—	—	—	—
Magnesium	3	811	03/16/01	NF	1	1	10000	—	—	—	—
Manganese	3	811	03/16/01	F	1	1	660	—	50	1/1	200
Manganese	3	811	03/16/01	NF	1	1	650	—	—	—	—
Mercury	3	811	03/16/01	F	1	0	—	[0.016]	2	0/1	—
Mercury	3	811	03/16/01	NF	1	0	—	[0.016]	—	—	2
Molybdenum	3	811	03/16/01	F	1	1	6.3	—	—	—	—
Molybdenum	3	811	03/16/01	NF	1	1	9.2	—	—	—	—
Nickel	3	811	03/16/01	F	1	1	11	—	100	0/1	200
Nickel	3	811	03/16/01	NF	1	1	16	—	—	—	—
Nitrate + Nitrite (as N)	3	811	03/16/01	F	1	0	—	[100]	10000	0/1	—
Perchlorate	3	811	03/16/01	F	1	0	—	[0.958]	—	—	—

Table A-12 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Frequency of Detects > Drinking Water MCL ^b (µg/L)	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Phosphorus (total)	3	811	03/16/01	F	1	0	—	[50]	—	—	—
Potassium	3	811	03/16/01	F	1	1	4600	—	—	—	—
Potassium	3	811	03/16/01	NF	1	1	4600	—	—	—	—
Selenium	3	811	03/16/01	F	1	0	—	[2.5]	50	0/1	0/1
Selenium	3	811	03/16/01	NF	1	0	—	[2.5]	—	—	—
Silica	3	811	03/16/01	F	1	1	59920	—	—	—	—
Silica	3	811	03/16/01	NF	1	1	62060	—	—	—	—
Silver	3	811	03/16/01	F	1	0	—	[0.83]	100	0/1	0/1
Silver	3	811	03/16/01	NF	1	0	—	[0.95]	—	—	—
Sodium	3	811	03/16/01	F	1	1	17000	—	—	—	—
Sodium	3	811	03/16/01	NF	1	1	17000	—	—	—	—
Strontrium	3	811	03/16/01	F	1	1	230	—	—	—	—
Strontrium	3	811	03/16/01	NF	1	1	230	—	—	—	—
Sulfate	3	811	03/16/01	F	1	1	11000	—	250000	0/1	600000 0/1
Thallium	3	811	03/16/01	F	1	0	—	[0.077]	2	0/1	—
Thallium	3	811	03/16/01	NF	1	1	0.664	—	—	—	—
Total Kjeldahl Nitrogen	3	811	03/16/01	F	1	1	280	—	—	—	—
Uranium	3	811	03/16/01	F	1	1	1.25	—	20	0/1	5000 0/1
Uranium	3	811	03/16/01	NF	1	1	1.38	—	—	—	—
Vanadium	3	811	03/16/01	F	1	1	0.9	—	—	—	—
Vanadium	3	811	03/16/01	NF	1	1	1.2	—	—	—	—
Zinc	3	811	03/16/01	F	1	0	—	[5.1]	5000	0/1	10000 0/1
Zinc	3	811	03/16/01	NF	1	0	—	[11]	—	—	—

Table A-12 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Stable Isotope (%)										
δD	3	811	03/16/01	NF	1	1	-76	—	—	—
$\delta^{15}\text{N} - \text{NH}_4$	3	811	03/16/01	NF	1	1	SV ⁱ	—	—	—
$\delta^{15}\text{N} - \text{NO}_3$	3	811	03/16/01	NF	1	1	SV	—	—	—
$\delta^{18}\text{O}$	3	811	03/16/01	NF	1	1	-11.1	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.^c NMED = New Mexico Environment Department.^d State of New Mexico groundwater standards are from *New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection*, 20 NMAC 6.2.^e NF = Nonfiltered.^f — = Not available or not applicable.^g NTU = Nephelometric turbidity unit.^h F = Filtered.ⁱ ISV = Insufficient sample volume.

Table A-13
Regional Well R-12 Screen 1 Second Round Sample Results: Data Summary for Detected Organic Chemicals

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Total Organic Carbon	1	468	03/14/01	NF ^e	1	1	8900	— ^f	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.^c NMED = New Mexico Environment Department.^d State of New Mexico groundwater standards are from *New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection*, 20 NMAC 6.2.^e NF = Nonfiltered.^f — = Not available or not applicable.

**Table A-14
Regional Well R-12 Screen 2 Second Round Sample Results: Data Summary for Detected Organic Chemicals**

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Total Organic Carbon	2	507	03/15/01	NF ^e	1	1	5200	— ^f	—	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.

^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from National Primary Drinking Water Regulations, 40 CFR Part 141. US EPA secondary MCLs are from National Secondary Drinking Water Regulations, 40 CFR Part 143. State of New Mexico MCLs are from Drinking Water Regulations, 20 NMAC 7.1.

^c NMED = New Mexico Environment Department.

^d State of New Mexico groundwater standards are from New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection, 20 NMAC 6.2.

^e NF = Nonfiltered.

^f — = Not available or not applicable.

**Table A-15
Regional Well R-12 Screen 3 Second Round Sample Results: Data Summary for Detected Organic Chemicals**

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Total Organic Carbon	3	811	03/16/01	NF ^e	1	1	5100	— ^f	—	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.

^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from National Primary Drinking Water Regulations, 40 CFR Part 141. US EPA secondary MCLs are from National Secondary Drinking Water Regulations, 40 CFR Part 143. State of New Mexico MCLs are from Drinking Water Regulations, 20 NMAC 7.1.

^c NMED = New Mexico Environment Department.

^d State of New Mexico groundwater standards are from New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection, 20 NMAC 6.2.

^e NF = Nonfiltered.

^f — = Not available or not applicable.

Table A-16
Regional Well R-12 Screen 1 Second Round Sample Results: Data Summary for Radionuclides

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (pCi/L)	Nondetected Value (pCi/L)	Drinking Water MCL ^b (pCi/L)	Frequency of Detects > Drinking Water MCL
Americium-241	1	468	03/14/01	F ^c	1	0	— ^d	[0.024]	15 ^e	0/1
Cesium-134	1	468	03/14/01	F	1	0	—	[0.2]	—	—
Cesium-137	1	468	03/14/01	F	1	0	—	[-0.2]	—	—
Cobalt-60	1	468	03/14/01	F	1	0	—	[0.7]	—	—
Europium-152	1	468	03/14/01	F	1	0	—	[2.1]	—	—
Gross Alpha Radiation	1	468	03/14/01	NF ^f	1	0	—	[0.83]	—	—
Gross Beta Radiation	1	468	03/14/01	NF	1	1	3.84	—	—	—
Gross Gamma Radiation	1	468	03/14/01	NF	1	1	315	—	—	—
Plutonium-238	1	468	03/14/01	F	1	0	—	[-0.01]	15 ^e	0/1
Plutonium-239	1	468	03/14/01	F	1	0	—	[0.001]	15 ^e	0/1
Ruthenium-106	1	468	03/14/01	F	1	0	—	[-2]	—	—
Sodium-22	1	468	03/14/01	F	1	0	—	[-0.2]	—	—
Strontrium-90	1	468	03/14/01	F	1	0	—	[-0.11]	8	0/1
Tritium	1	468	03/14/01	NF	1	1	18.71	—	200000	0/1
Uranium-234	1	468	03/14/01	F	1	0	—	[0.037]	—	—
Uranium-235	1	468	03/14/01	F	1	0	—	[-0.001]	—	—
Uranium-238	1	468	03/14/01	F	1	0	—	[0.024]	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.

^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.

^c F = Filtered.

^d — = Not available or not applicable.

^e Based on an MCL of 15 pCi/L (including radium-226, but excluding radon and uranium).
^f NF = Nonfiltered.

Table A-17
Regional Well R-12 Screen 2 Second Round Sample Results: Data Summary for Radionuclides

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (pCi/L)	Nondetected Value (pCi/L)	Drinking Water MCL ^b (pCi/L)	Frequency of Detects > Drinking Water MCL
Americium-241	2	507	03/15/01	F ^c	1	0	— ^d	[0.018]	15 ^e	0/1
Cesium-134	2	507	03/15/01	F	1	0	—	[1]	—	—
Cesium-137	2	507	03/15/01	F	1	0	—	[0.1]	—	—
Cobalt-60	2	507	03/15/01	F	1	0	—	[-0.2]	—	—
Europium-152	2	507	03/15/01	F	1	0	—	[24]	—	—
Gross Alpha Radiation	2	507	03/15/01	NF ^f	1	0	—	[1.6]	—	—
Gross Beta Radiation	2	507	03/15/01	NF	1	0	—	[2.3]	—	—
Gross Gamma Radiation	2	507	03/15/01	NF	1	1	298	—	—	—
Plutonium-238	2	507	03/15/01	F	1	0	—	[0]	15 ^e	0/1
Plutonium-239	2	507	03/15/01	F	1	0	—	[0.003]	15 ^e	0/1
Ruthenium-106	2	507	03/15/01	F	1	0	—	[-14]	—	—
Sodium-22	2	507	03/15/01	F	1	0	—	[0]	—	—
Strontrium-90	2	507	03/15/01	F	1	0	—	[-0.15]	8	0/1
Tritium	2	507	03/15/01	NF	1	1	110.80	—	200000	0/1
Uranium-234	2	507	03/15/01	F	1	1	0.3	—	—	—
Uranium-235	2	507	03/15/01	F	1	0	—	[0.03]	—	—
Uranium-238	2	507	03/15/01	F	1	1	0.29	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.

^b Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from National Primary Drinking Water Regulations, 40 CFR Part 141. US EPA secondary MCLs are from National Secondary Drinking Water Regulations, 40 CFR Part 143. State of New Mexico MCLs are from Drinking Water Regulations, 20 NMAC 7.1.

^c F = Filtered.

^d — = Not available or not applicable.

^e Based on an MCL of 15 pCi/L (including radium-226, but excluding radon and uranium).

^f NF = Nonfiltered.

Table A-18
Regional Well R-12 Screen 3 Second Round Sample Results: Data Summary for Radionuclides

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (pCi/L)	Nondetected Value (pCi/L)	Drinking Water MCL ^b (pCi/L)	Frequency of Detects > Drinking Water MCL
Americium-241	3	811	03/16/01	F ^c	1	0	— ^d	[<0.002]	15 ^e	0/1
Cesium-134	3	811	03/16/01	F	1	0	—	[<3.4]	—	—
Cesium-137	3	811	03/16/01	F	1	0	—	[<1.4]	—	—
Cobalt-60	3	811	03/16/01	F	1	0	—	[<1.4]	—	—
Europium-152	3	811	03/16/01	F	1	0	—	[<7]	—	—
Gross Alpha Radiation	3	811	03/16/01	NF ^f	1	0	—	[1.3]	—	—
Gross Beta Radiation	3	811	03/16/01	NF	1	1	4.1	—	—	—
Gross Gamma Radiation	3	811	03/16/01	NF	1	1	297	—	—	—
Plutonium-238	3	811	03/16/01	F	1	0	—	[0]	15 ^e	0/1
Plutonium-239	3	811	03/16/01	F	1	0	—	[0.005]	15 ^e	0/1
Ruthenium-106	3	811	03/16/01	F	1	0	—	[<14]	—	—
Sodium-22	3	811	03/16/01	F	1	0	—	[<1.5]	—	—
Strontrium-90	3	811	03/16/01	F	1	0	—	[<0.03]	8	0/1
Tritium	3	811	03/16/01	NF	1	1	63.86	—	200000	0/1
Uranium-234	3	811	03/16/01	F	1	1	0.73	—	—	—
Uranium-235	3	811	03/16/01	F	1	0	—	[0.063]	—	—
Uranium-238	3	811	03/16/01	F	1	1	0.43	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.

^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.

^c F = Filtered.

^d — = Not available or not applicable.

^e Based on an MCL of 15 pCi/L (including radium-226, but excluding radon and uranium).

^f NF = Nonfiltered.

**Table A-19
Regional Well R-12 Screen 1 Third Round Sample Results: Data Summary for Inorganic Chemicals**

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMEDC Groundwater Standard ^c (µg/L)	Frequency of Detects > NMEDC Groundwater Standard
Field Parameter												
Field Alkalinity (total as CaCO ₃)	1	468	06/13/01	NF ^e	1	1	— ^f	—	—	—	—	—
pH	1	468	06/13/01	NF	1	1	8.63	—	>6 & <9	0/1	>6 & <9	0/1
Specific Conductance (µS/cm)	1	468	06/13/01	NF	1	1	175	—	—	0/1	—	0/1
Temperature (°C)	1	468	06/13/01	NF	1	1	19.9	—	—	0/1	—	0/1
Turbidity (NTU ^g)	1	468	06/13/01	NF	1	1	5.3	—	—	0/1	—	0/1
Analyte												
Lab Alkalinity (total as CaCO ₃)	1	468	06/13/01	Fh	1	1	71000	—	—	—	—	—
Aluminum	1	468	06/13/01	F	1	0	—	[37]	50	0/1	5000	0/1
Aluminum	1	468	06/13/01	NF	1	0	—	[120]	—	—	—	—
Ammonia (as N)	1	468	06/13/01	F	1	1	3100	—	—	—	—	—
Antimony	1	468	06/13/01	F	1	0	—	[0.284]	6	0/1	—	—
Antimony	1	468	06/13/01	NF	1	0	—	[0.761]	—	—	—	—
Arsenic	1	468	06/13/01	F	1	0	—	[1.5]	50	0/1	100	0/1
Arsenic	1	468	06/13/01	NF	1	1	1.8	—	—	—	—	—
Barium	1	468	06/13/01	F	1	1	31	—	2000	0/1	1000	0/1
Barium	1	468	06/13/01	NF	1	1	37	—	—	—	—	—
Beryllium	1	468	06/13/01	F	1	0	—	[0.012]	4	0/1	—	—
Beryllium	1	468	06/13/01	NF	1	1	0.044	—	—	—	—	—
Boron	1	468	06/13/01	F	1	1	120	—	—	—	750	0/1
Boron	1	468	06/13/01	NF	1	1	130	—	—	—	—	—
Bromide	1	468	06/13/01	F	1	0	—	[200]	—	—	—	—
Cadmium	1	468	06/13/01	F	1	0	—	[0.084]	5	0/1	10	0/1
Cadmium	1	468	06/13/01	NF	1	0	—	[0.084]	—	—	—	—

Table A-19 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Frequency of Detects > Drinking Water MCL ^b	NMED Groundwater Standard ^c (µg/L)	Frequency of Detects > NMED Groundwater Standard
Calcium	1	468	06/13/01	F	1	1	4800	—	—	—	—
Calcium	1	468	06/13/01	NF	1	1	5300	—	—	—	—
Chloride	1	468	06/13/01	F	1	1	12000	—	250000	0/1	250000
Chromium (total)	1	468	06/13/01	F	1	0	—	[0.21]	100	0/1	50
Chromium (total)	1	468	06/13/01	NF	1	0	—	[2]	—	—	—
Cobalt	1	468	06/13/01	F	1	0	—	[0.37]	—	—	50
Cobalt	1	468	06/13/01	NF	1	0	—	[0.37]	—	—	—
Copper	1	468	06/13/01	F	1	0	—	[2.4]	1300	0/1	1000
Copper	1	468	06/13/01	NF	1	1	8.7	—	—	—	—
Cyanide (total)	1	468	06/13/01	NF	1	0	—	[10]	—	—	—
Fluoride	1	468	06/13/01	F	1	1	510	—	4000	0/1	1600
Iron	1	468	06/13/01	F	1	0	—	[150]	300	0/1	1000
Iron	1	468	06/13/01	NF	1	1	610	—	—	—	—
Lead	1	468	06/13/01	F	1	0	—	[1.1]	15	0/1	50
Lead	1	468	06/13/01	NF	1	1	4.9	—	—	—	—
Magnesium	1	468	06/13/01	F	1	1	1200	—	—	—	—
Magnesium	1	468	06/13/01	NF	1	1	1400	—	—	—	—
Manganese	1	468	06/13/01	F	1	1	200	—	50	1/1	200
Manganese	1	468	06/13/01	NF	1	1	250	—	—	—	—
Mercury	1	468	06/13/01	F	1	0	—	[0.033]	2	0/1	—
Mercury	1	468	06/13/01	NF	1	0	—	[0.033]	—	—	2
Molybdenum	1	468	06/13/01	F	1	1	25	—	—	—	—
Molybdenum	1	468	06/13/01	NF	1	1	28	—	—	—	—
Nickel	1	468	06/13/01	F	1	0	—	[1.9]	100	0/1	200
Nickel	1	468	06/13/01	NF	1	0	—	[4.2]	—	—	—
Nitrate + Nitrite (as N)	1	468	06/13/01	F	1	0	—	[50]	10000	0/1	—
Perchlorate	1	468	06/13/01	F	1	0	—	[0.958]	—	—	—

Table A-19 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Frequency of Detects > Drinking Water MCL ^b (µg/L)	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Phosphorus (as P)	1	468	06/13/01	F	1	1	440	—	—	—	—
Potassium	1	468	06/13/01	F	1	1	2200	—	—	—	—
Potassium	1	468	06/13/01	NF	1	1	2300	—	—	—	—
Selenium	1	468	06/13/01	F	1	0	—	[1.9]	50	0/1	0/1
Selenium	1	468	06/13/01	NF	1	0	—	[1.9]	—	—	—
Silica	1	468	06/13/01	F	1	1	25646	—	—	—	—
Silica	1	468	06/13/01	NF	1	1	27936	—	—	—	—
Silver	1	468	06/13/01	F	1	0	—	[0.57]	100	0/1	50
Silver	1	468	06/13/01	NF	1	0	—	[0.57]	—	—	—
Sodium	1	468	06/13/01	F	1	1	21000	—	—	—	—
Sodium	1	468	06/13/01	NF	1	1	21000	—	—	—	—
Strontrium	1	468	06/13/01	F	1	1	25	—	—	—	—
Strontrium	1	468	06/13/01	NF	1	1	27	—	—	—	—
Sulfate	1	468	06/13/01	F	1	0	—	[1000]	250000	0/1	600000
Thallium	1	468	06/13/01	F	1	1	0.158	—	2	0/1	—
Thallium	1	468	06/13/01	NF	1	1	0.299	—	—	—	—
Total Kjeldahl Nitrogen	1	468	06/13/01	F	1	1	3300	—	—	—	—
Uranium	1	468	06/13/01	F	1	1	0.027	—	—	—	—
Uranium	1	468	06/13/01	NF	1	1	0.086	—	—	—	—
Vanadium	1	468	06/13/01	F	1	0	—	[0.38]	—	—	—
Vanadium	1	468	06/13/01	NF	1	0	—	[0.38]	—	—	—
Zinc	1	468	06/13/01	F	1	0	—	[0.39]	5000	0/1	10000
Zinc	1	468	06/13/01	NF	1	0	—	[2.3]	—	—	—

Table A-19 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Stable Isotope (%)												
δD	1	468	06/13/01	NF	1	1	-78	—	—	—	—	—
δ ¹⁵ N – NH ₄	1	468	06/13/01	NF	1	1	-6.1	—	—	—	—	—
δ ¹⁵ N – NO ₃	1	468	06/13/01	NF	1	1	SV ⁱ	—	—	—	—	—
δ ¹⁸ O	1	468	06/13/01	NF	1	1	-11.4	—	—	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.^c NMED = New Mexico Environment Department.^d State of New Mexico groundwater standards are from *New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection*, 20 NMAC 6.2.^e NF = Nonfiltered.^f — = Not available or not applicable.^g NTU = Nephelometric turbidity unit.^h F = Filtered.ⁱ |SV = Insufficient sample volume.

**Table A-20
Regional Well R-12 Screen 2 Third Round Sample Results: Data Summary for Inorganic Chemicals**

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMEDC Groundwater Standard ^c (µg/L)	Frequency of Detects > NMED Groundwater Standard
Field Parameter												
Field Alkalinity (total as CaCO ₃)	2	507	06/13/01	NF ^e	1	1	—	—	—	—	—	—
pH	2	507	06/13/01	NF	1	1	8.89	—	>6 & <9	0/1	>6 & <9	0/1
Specific Conductance (µS/cm)	2	507	06/13/01	NF	1	1	155	—	—	0/1	—	0/1
Temperature (°C)	2	507	06/13/01	NF	1	1	18.0	—	—	0/1	—	0/1
Turbidity (NTU ^g)	2	507	06/13/01	NF	1	1	0.9	—	—	0/1	—	0/1
Analyte												
Lab Alkalinity (total as CaCO ₃)	2	507	06/13/01	Fh	1	1	63000	—	—	—	—	—
Aluminum	2	507	06/13/01	F	1	0	—	[9]	50	0/1	5000	0/1
Aluminum	2	507	06/13/01	NF	1	0	—	[7.6]	—	—	—	—
Ammonia (as N)	2	507	06/13/01	F	1	1	310	—	—	—	—	—
Antimony	2	507	06/13/01	F	1	0	—	[0.196]	6	0/1	—	—
Antimony	2	507	06/13/01	NF	1	0	—	[0.242]	—	—	—	—
Arsenic	2	507	06/13/01	F	1	0	—	[1.5]	50	0/1	100	0/1
Arsenic	2	507	06/13/01	NF	1	0	—	[1.5]	—	—	—	—
Barium	2	507	06/13/01	F	1	1	11	—	2000	0/1	1000	0/1
Barium	2	507	06/13/01	NF	1	1	16	—	—	—	—	—
Beryllium	2	507	06/13/01	F	1	0	—	[0.012]	4	0/1	—	—
Beryllium	2	507	06/13/01	NF	1	0	—	[0.012]	—	—	—	—
Boron	2	507	06/13/01	F	1	1	43	—	—	—	750	0/1
Boron	2	507	06/13/01	NF	1	1	30	—	—	—	—	—
Bromide	2	507	06/13/01	F	1	0	—	[200]	—	—	—	—
Cadmium	2	507	06/13/01	F	1	0	—	[0.066]	5	0/1	10	0/1
Cadmium	2	507	06/13/01	NF	1	0	—	[0.084]	—	—	—	—

Table A-20 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Frequency of Detects > Drinking Water MCL ^b (µg/L)	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Calcium	2	507	06/13/01	F	1	1	14000	—	—	—	—
Calcium	2	507	06/13/01	NF	1	1	15000	—	—	—	—
Chloride	2	507	06/13/01	F	1	1	5900	—	250000	0/1	250000
Chromium (total)	2	507	06/13/01	F	1	0	—	[0.21]	100	0/1	50
Chromium (total)	2	507	06/13/01	NF	1	0	—	[0.21]	—	—	—
Cobalt	2	507	06/13/01	F	1	0	—	[0.37]	—	—	50
Cobalt	2	507	06/13/01	NF	1	0	—	[1]	—	—	—
Copper	2	507	06/13/01	F	1	0	—	[0.27]	1300	0/1	1000
Copper	2	507	06/13/01	NF	1	0	—	[0.95]	—	—	—
Cyanide (total)	2	507	06/13/01	NF	1	0	—	[10]	—	—	—
Fluoride	2	507	06/13/01	F	1	1	530	—	4000	0/1	1600
Iron	2	507	06/13/01	F	1	0	—	[44]	300	0/1	1000
Iron	2	507	06/13/01	NF	1	0	—	[59]	—	—	—
Lead	2	507	06/13/01	F	1	0	—	[0.037]	15	0/1	50
Lead	2	507	06/13/01	NF	1	0	—	[1.1]	—	—	—
Magnesium	2	507	06/13/01	F	1	1	2000	—	—	—	—
Magnesium	2	507	06/13/01	NF	1	1	2300	—	—	—	—
Manganese	2	507	06/13/01	F	1	1	34	—	50	0/1	200
Manganese	2	507	06/13/01	NF	1	1	77	—	—	—	—
Mercury	2	507	06/13/01	F	1	0	—	[0.033]	2	0/1	—
Mercury	2	507	06/13/01	NF	1	0	—	[0.033]	—	—	2
Molybdenum	2	507	06/13/01	F	1	1	8.3	—	—	—	—
Molybdenum	2	507	06/13/01	NF	1	1	5.6	—	—	—	—
Nickel	2	507	06/13/01	F	1	0	—	[0.53]	100	0/1	200
Nickel	2	507	06/13/01	NF	1	0	—	[2.6]	—	—	—
Nitrate + Nitrite (as N)	2	507	06/13/01	F	1	1	51	—	10000	0/1	—
Oxalate	2	507	06/13/01	F	1	0	—	[190]	—	—	—

Table A-20 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Frequency of Detects > Drinking Water MCL ^b (µg/L)	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Perchlorate	2	507	06/13/01	F	1	0	—	[0.958]	—	—	—
Phosphorus (as P)	2	507	06/13/01	F	1	1	67	—	—	—	—
Potassium	2	507	06/13/01	F	1	1	2100	—	—	—	—
Potassium	2	507	06/13/01	NF	1	1	2200	—	—	—	—
Selenium	2	507	06/13/01	F	1	0	—	[1.9]	50	0/1	50
Selenium	2	507	06/13/01	NF	1	0	—	[1.9]	—	—	—
Silica	2	507	06/13/01	F	1	1	32100	—	—	—	—
Silica	2	507	06/13/01	NF	1	1	34240	—	—	—	—
Silver	2	507	06/13/01	F	1	0	—	[0.57]	100	0/1	50
Silver	2	507	06/13/01	NF	1	0	—	[0.57]	—	—	—
Sodium	2	507	06/13/01	F	1	1	9000	—	—	—	—
Sodium	2	507	06/13/01	NF	1	1	9000	—	—	—	—
Strontrium	2	507	06/13/01	F	1	1	61	—	—	—	—
Strontrium	2	507	06/13/01	NF	1	1	64	—	—	—	—
Sulfate	2	507	06/13/01	F	1	1	8500	—	250000	0/1	600000
Thallium	2	507	06/13/01	F	1	1	0.095	—	2	0/1	—
Thallium	2	507	06/13/01	NF	1	1	0.115	—	—	—	—
Total Kjeldahl Nitrogen	2	507	06/13/01	F	1	1	470	—	—	—	—
Uranium	2	507	06/13/01	F	1	1	0.431	—	—	—	—
Uranium	2	507	06/13/01	NF	1	1	0.372	—	—	—	—
Vanadium	2	507	06/13/01	F	1	0	—	[2.6]	—	—	—
Vanadium	2	507	06/13/01	NF	1	0	—	[3.3]	—	—	—
Zinc	2	507	06/13/01	F	1	0	—	[0.44]	5000	0/1	10000
Zinc	2	507	06/13/01	NF	1	0	—	[0.84]	—	—	—

Table A-20 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Stable Isotope (%)												
δD	2	507	06/13/01	NF	1	1	-78	—	—	—	—	—
$\delta^{15}\text{N} - \text{NH}_4$	2	507	06/13/01	NF	1	1	SV ⁱ	—	—	—	—	—
$\delta^{15}\text{N} - \text{NO}_3$	2	507	06/13/01	NF	1	1	SV	—	—	—	—	—
$\delta^{18}\text{O}$	2	507	06/13/01	NF	1	1	-11.5	—	—	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.^c NMED = New Mexico Environment Department.^d State of New Mexico groundwater standards are from *New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection*, 20 NMAC 6.2.^e NF = Nonfiltered.^f — = Not available or not applicable.^g NTU = Nephelometric turbidity unit.^h F = Filtered.ⁱ ISV = Insufficient sample volume.

Table A-21
Regional Well R-12 Screen 3 Third Round Sample Results: Data Summary for Inorganic Chemicals

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMEDC Groundwater Standard ^c (µg/L)	Frequency of Detects > NMEDC Groundwater Standard
Field Parameter												
Field Alkalinity (total as CaCO ₃)	3	811	06/14/01	NF ^e	1	1	91000	— ^f	—	—	—	—
pH	3	811	06/14/01	NF	1	1	7.43	—	>6 & <9	0/1	>6 & <9	0/1
Specific Conductance (µS/cm)	3	811	06/14/01	NF	1	1	381	—	—	0/1	—	0/1
Temperature (°C)	3	811	06/14/01	NF	1	1	22.3	—	—	0/1	—	0/1
Turbidity (NTU ^g)	3	811	06/14/01	NF	1	1	5.6	—	—	0/1	—	0/1
Analyte												
Lab Alkalinity (total as CaCO ₃)	3	811	06/14/01	F ^h	1	0	—	[180000]	—	—	—	—
Aluminum	3	811	06/14/01	F	1	0	—	[34]	50	0/1	5000	0/1
Aluminum	3	811	06/14/01	NF	1	0	—	[36]	—	—	—	—
Ammonia (as N)	3	811	06/14/01	F	1	0	—	[100]	—	—	—	—
Antimony	3	811	06/14/01	F	1	0	—	[0.153]	6	0/1	—	—
Antimony	3	811	06/14/01	NF	1	0	—	[0.153]	—	—	—	—
Arsenic	3	811	06/14/01	F	1	0	—	[1.5]	50	0/1	100	0/1
Arsenic	3	811	06/14/01	NF	1	0	—	[1.5]	—	—	—	—
Barium	3	811	06/14/01	F	1	1	140	—	2000	0/1	1000	0/1
Barium	3	811	06/14/01	NF	1	1	140	—	—	—	—	—
Beryllium	3	811	06/14/01	F	1	0	—	[0.012]	4	0/1	—	—
Beryllium	3	811	06/14/01	NF	1	0	—	[0.012]	—	—	—	—
Boron	3	811	06/14/01	F	1	1	68	—	—	—	750	0/1
Boron	3	811	06/14/01	NF	1	1	73	—	—	—	—	—
Bromide	3	811	06/14/01	F	1	0	—	[200]	—	—	—	—
Cadmium	3	811	06/14/01	F	1	0	—	[0.084]	5	0/1	10	0/1
Cadmium	3	811	06/14/01	NF	1	0	—	[0.084]	—	—	—	—

Table A-21 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Frequency of Detects > Drinking Water MCL ^b (µg/L)	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Calcium	3	811	06/14/01	F	1	1	46000	—	—	—	—
Calcium	3	811	06/14/01	NF	1	1	46000	—	—	—	—
Chloride	3	811	06/14/01	F	1	1	9300	—	—	—	—
Chromium (total)	3	811	06/14/01	F	1	0	—	[0.21]	100	0/1	250000 0/1
Chromium (total)	3	811	06/14/01	NF	1	1	4.9	—	—	—	—
Cobalt	3	811	06/14/01	F	1	1	1.4	—	—	—	—
Cobalt	3	811	06/14/01	NF	1	1	1.2	—	—	—	—
Copper	3	811	06/14/01	F	1	0	—	[0.27]	—	—	—
Copper	3	811	06/14/01	NF	1	0	—	[0.27]	—	—	—
Cyanide (total)	3	811	06/14/01	NF	1	0	—	[10]	—	—	—
Fluoride	3	811	06/14/01	F	1	1	470	—	4000	0/1	1600 0/1
Iron	3	811	06/14/01	F	1	0	—	[87]	300	0/1	1000 0/1
Iron	3	811	06/14/01	NF	1	1	490	—	—	—	—
Lead	3	811	06/14/01	F	1	0	—	[1.1]	15	0/1	50 0/1
Lead	3	811	06/14/01	NF	1	0	—	[1.1]	—	—	—
Magnesium	3	811	06/14/01	F	1	1	11000	—	—	—	—
Magnesium	3	811	06/14/01	NF	1	1	11000	—	—	—	—
Manganese	3	811	06/14/01	F	1	1	550	—	50	1/1	200 1/1
Manganese	3	811	06/14/01	NF	1	1	540	—	—	—	—
Mercury	3	811	06/14/01	F	1	0	—	[0.033]	2	0/1	—
Mercury	3	811	06/14/01	NF	1	0	—	[0.033]	—	—	2 0/1
Molybdenum	3	811	06/14/01	F	1	1	3.9	—	—	—	—
Molybdenum	3	811	06/14/01	NF	1	1	5.8	—	—	—	—
Nickel	3	811	06/14/01	F	1	1	9.8	—	100	0/1	200 0/1
Nickel	3	811	06/14/01	NF	1	1	12	—	—	—	—
Nitrate + Nitrite (as N)	3	811	06/14/01	F	1	0	—	[50]	10000	0/1	—
Perchlorate	3	811	06/14/01	F	1	0	—	[0.958]	—	—	—

Table A-21 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Frequency of Detects > Drinking Water MCL ^b (µg/L)	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Phosphorus (as P)	3	811	06/14/01	F	1	0	—	[50]	—	—	—
Potassium	3	811	06/14/01	F	1	1	4600	—	—	—	—
Potassium	3	811	06/14/01	NF	1	1	4600	—	—	—	—
Selenium	3	811	06/14/01	F	1	1	2.1	—	50	0/1	0/1
Selenium	3	811	06/14/01	NF	1	0	—	[1.9]	—	—	—
Silica	3	811	06/14/01	F	1	1	59920	—	—	—	—
Silica	3	811	06/14/01	NF	1	1	62060	—	—	—	—
Silver	3	811	06/14/01	F	1	0	—	[0.57]	100	0/1	0/1
Silver	3	811	06/14/01	NF	1	1	0.65	—	—	—	—
Sodium	3	811	06/14/01	F	1	1	17000	—	—	—	—
Sodium	3	811	06/14/01	NF	1	1	17000	—	—	—	—
Strontrium	3	811	06/14/01	F	1	1	230	—	—	—	—
Strontrium	3	811	06/14/01	NF	1	1	240	—	—	—	—
Sulfate	3	811	06/14/01	F	1	1	10000	—	250000	0/1	600000 0/1
Thallium	3	811	06/14/01	F	1	0	—	[0.077]	2	0/1	—
Thallium	3	811	06/14/01	NF	1	1	0.109	—	—	—	—
Total Kjeldahl Nitrogen	3	811	06/14/01	F	1	1	400	—	—	—	—
Uranium	3	811	06/14/01	F	1	1	1.95	—	—	—	—
Uranium	3	811	06/14/01	NF	1	1	1.95	—	—	—	—
Vanadium	3	811	06/14/01	F	1	0	—	[0.38]	—	—	—
Vanadium	3	811	06/14/01	NF	1	0	—	[0.38]	—	—	—
Zinc	3	811	06/14/01	F	1	0	—	[0.31]	5000	0/1	10000 0/1
Zinc	3	811	06/14/01	NF	1	1	4.8	—	—	—	—

Table A-21 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Stable Isotope (%)										
δD	3	811	06/14/01	NF	1	1	-74	—	—	—
$\delta^{15}\text{N} - \text{NH}_4$	3	811	06/14/01	NF	1	1	ISV ⁱ	—	—	—
$\delta^{15}\text{N} - \text{NO}_3$	3	811	06/14/01	NF	1	1	ISV	—	—	—
$\delta^{18}\text{O}$	3	811	06/14/01	NF	1	1	-10.8	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.^c NMED = New Mexico Environment Department.^d State of New Mexico groundwater standards are from *New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection*, 20 NMAC 6.2.^e NF = Nonfiltered.^f — = Not available or not applicable.^g NTU = Nephelometric turbidity unit.^h F = Filtered.ⁱ ISV = Insufficient sample volume.**Table A-22**
Regional Well R-12 Screen 1 Third Round Sample Results: Data Summary for Detected Organic Chemicals

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Total Organic Carbon	1	468	06/13/01	NF ^e	1	1	12000	— ^f	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.^c NMED = New Mexico Environment Department.^d State of New Mexico groundwater standards are from *New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection*, 20 NMAC 6.2.^e NF = Nonfiltered.^f — = Not available or not applicable.

**Table A-23
Regional Well R-12 Screen 2 Third Round Sample Results: Data Summary for Detected Organic Chemicals**

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Total Organic Carbon	2	507	06/13/01	NF ^e	1	1	2700	— ^f	—	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.

^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.

^c NMED = New Mexico Environment Department.

^d State of New Mexico groundwater standards are from *New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection*, 20 NMAC 6.2.

^e NF = Nonfiltered.

^f — = Not available or not applicable.

**Table A-24
Regional Well R-12 Screen 3 Third Round Sample Results: Data Summary for Detected Organic Chemicals**

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
No Organic Chemistry	3	811	06/14/01	— ^e	—	—	—	—	—	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.

^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.

^c NMED = New Mexico Environment Department.

^d State of New Mexico groundwater standards are from *New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection*, 20 NMAC 6.2.

^e — = Not available or not applicable.

Table A-25
Regional Well R-12 Screen 1 Third Round Sample Results: Data Summary for Radionuclides

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (pCi/L)	Nondetected Value (pCi/L)	Drinking Water MCL ^b (pCi/L)	Frequency of Detects > Drinking Water MCL
Americium-241	1	468	06/13/01	F ^c	1	0	— ^d	[0.032]	15 ^e	0/1
Cesium-134	1	468	06/13/01	F	1	0	—	[3.3]	—	—
Cesium-137	1	468	06/13/01	F	1	0	—	[0.2]	—	—
Cobalt-60	1	468	06/13/01	F	1	0	—	[1.2]	—	—
Europium-152	1	468	06/13/01	F	1	0	—	[1]	—	—
Gross Alpha Radiation	1	468	06/13/01	NF ^f	1	0	—	[1.28]	—	—
Gross Beta Radiation	1	468	06/13/01	NF	1	1	3.1	—	—	—
Gross Gamma Radiation	1	468	06/13/01	NF	1	1	119	—	—	—
Plutonium-238	1	468	06/13/01	F	1	0	—	[-0.0061]	15 ^e	0/1
Plutonium-239	1	468	06/13/01	F	1	0	—	[0]	15 ^e	0/1
Ruthenium-106	1	468	06/13/01	F	1	0	—	[-21]	—	—
Strontrium-90	1	468	06/13/01	F	1	0	—	[0.1]	8	0/1
Tritium	1	468	06/13/01	NF	1	1	187.37	—	20000	0/1
Uranium-234	1	468	06/13/01	F	1	1	0.082	—	—	—
Uranium-235	1	468	06/13/01	F	1	0	—	[0.013]	—	—
Uranium-238	1	468	06/13/01	F	1	0	—	[0.028]	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from National Primary Drinking Water Regulations, 40 CFR Part 141. US EPA secondary MCLs are from National Secondary Drinking Water Regulations, 40 CFR Part 143. State of New Mexico MCLs are from Drinking Water Regulations, 20 NMAC 7.1.^c F = Filtered.^d — = Not available or not applicable.^e Based on an MCL of 15 pCi/L (including radium-226, but excluding radon and uranium).
^f NF = Nonfiltered.

Table A-26
Regional Well R-12 Screen 2 Third Round Sample Results: Data Summary for Radionuclides

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (pCi/L)	Nondetected Value (pCi/L)	Drinking Water MCL ^b (pCi/L)	Frequency of Detects > Drinking Water MCL
Americium-241	2	507	06/13/01	F ^c	1	0	— ^d	[0.009]	15 ^e	0/1
Cesium-134	2	507	06/13/01	F	1	0	—	[1.3]	—	—
Cesium-137	2	507	06/13/01	F	1	0	—	[0.9]	—	—
Cobalt-60	2	507	06/13/01	F	1	0	—	[2.6]	—	—
Europium-152	2	507	06/13/01	F	1	0	—	[6]	—	—
Gross Alpha Radiation	2	507	06/13/01	NF ^f	1	1	1.55	—	—	—
Gross Beta Radiation	2	507	06/13/01	NF	1	1	1.78	—	—	—
Gross Gamma Radiation	2	507	06/13/01	NF	1	1	162	—	—	—
Plutonium-238	2	507	06/13/01	F	1	0	—	[-0.0019]	15 ^e	0/1
Plutonium-239	2	507	06/13/01	F	1	0	—	[0.006]	15 ^e	0/1
Ruthenium-106	2	507	06/13/01	F	1	0	—	[8]	—	—
Strontrium-90	2	507	06/13/01	F	1	0	—	[-1.2]	8	0/1
Tritium	2	507	06/13/01	NF	1	1	97.68	—	20000	0/1
Uranium-234	2	507	06/13/01	F	1	1	0.292	—	—	—
Uranium-235	2	507	06/13/01	F	1	0	—	[0.019]	—	—
Uranium-238	2	507	06/13/01	F	1	1	0.192	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.

^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from National Primary Drinking Water Regulations, 40 CFR Part 141. US EPA secondary MCLs are from National Secondary Drinking Water Regulations, 40 CFR Part 143. State of New Mexico MCLs are from Drinking Water Regulations, 20 NMAC 7.1.

^c F = Filtered.

^d — = Not available or not applicable.

^e Based on an MCL of 15 pCi/L (including radium-226, but excluding radon and uranium).
^f NF = Nonfiltered.

Table A-27
Regional Well R-12 Screen 3 Third Round Sample Results: Data Summary for Radionuclides

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (pCi/L)	Nondetected Value (pCi/L)	Drinking Water MCL ^b (pCi/L)	Frequency of Detects > Drinking Water MCL
Americium-241	3	811	06/14/01	F ^c	1	0	— ^d	[0.005]	15 ^e	0/1
Cesium-134	3	811	06/14/01	F	1	0	—	[0.1]	—	—
Cesium-137	3	811	06/14/01	F	1	0	—	[-1.4]	—	—
Cobalt-60	3	811	06/14/01	F	1	0	—	[0]	—	—
Europium-152	3	811	06/14/01	F	1	0	—	[25]	—	—
Gross Alpha Radiation	3	811	06/14/01	NF ^f	1	0	—	[1.2]	—	—
Gross Beta Radiation	3	811	06/14/01	NF	1	1	3.9	—	—	—
Gross Gamma Radiation	3	811	06/14/01	NF	1	1	153	—	—	—
Plutonium-238	3	811	06/14/01	F	1	0	—	[0.005]	15 ^e	0/1
Plutonium-239	3	811	06/14/01	F	1	0	—	[0.007]	15 ^e	0/1
Ruthenium-106	3	811	06/14/01	F	1	0	—	[-17]	—	—
Srtronium-90	3	811	06/14/01	F	1	0	—	[-0.6]	8	0/1
Tritium	3	811	06/14/01	NF	1	1	57.14	—	20000	0/1
Uranium-234	3	811	06/14/01	F	1	1	1.2	—	—	—
Uranium-235	3	811	06/14/01	F	1	0	—	[0.052]	—	—
Uranium-238	3	811	06/14/01	F	1	1	0.67	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.

^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from National Primary Drinking Water Regulations, 40 CFR Part 141. US EPA secondary MCLs are from National Secondary Drinking Water Regulations, 40 CFR Part 143. State of New Mexico MCLs are from Drinking Water Regulations, 20 NMAC 7.1.

^c F = Filtered.

^d — = Not available or not applicable.

^e Based on an MCL of 15 pCi/L (including radium-226, but excluding radon and uranium).
^f NF = Nonfiltered.

Table A-28
Regional Well R-12 Screen 1 Fourth Round Sample Results: Data Summary for Inorganic Chemicals

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMEDC Groundwater Standard ^c (µg/L)	Frequency of Detects > NMED Groundwater Standard
Field Parameter												
Field Alkalinity (total as CaCO ₃)	1	468	09/07/01	NF ^e	1	1	— ^f	—	—	—	—	—
pH	1	468	09/07/01	NF	1	1	8.94	—	>6 & <9	0/1	>6 & <9	0/1
Specific Conductance (µS/cm)	1	468	09/07/01	NF	1	1	122.3	—	—	0/1	—	0/1
Temperature (°C)	1	468	09/07/01	NF	1	1	21.3	—	—	0/1	—	0/1
Turbidity (NTU ^g)	1	468	09/07/01	NF	1	1	6.5	—	—	0/1	—	0/1
Analyte												
Lab Alkalinity (as CaCO ₃)	1	468	09/07/01	F ^h	1	1	52500	—	—	—	—	—
Aluminum	1	468	09/07/01	F	1	1	72.2	—	50	1/1	5000	0/1
Aluminum	1	468	09/07/01	NF	1	1	283	—	—	—	—	—
Ammonia	1	468	09/07/01	F	1	1	3120	—	—	—	—	—
Antimony	1	468	09/07/01	F	1	0	—	[0.21]	6	0/1	—	—
Antimony	1	468	09/07/01	NF	1	0	—	[0.07]	—	—	—	—
Arsenic	1	468	09/07/01	F	1	0	—	[2.6]	50	0/1	100	0/1
Arsenic	1	468	09/07/01	NF	1	0	—	[2.6]	—	—	—	—
Barium	1	468	09/07/01	F	1	1	22.3	—	2000	0/1	1000	0/1
Barium	1	468	09/07/01	NF	1	1	28.3	—	—	—	—	—
Beryllium	1	468	09/07/01	F	1	1	0.01	—	4	0/1	—	—
Beryllium	1	468	09/07/01	NF	1	1	0.05	—	—	—	—	—
Boron	1	468	09/07/01	F	1	1	122	—	—	—	750	0/1
Boron	1	468	09/07/01	NF	1	1	123	—	—	—	—	—
Bromide	1	468	09/07/01	F	2	0	—	[20]	—	5	0/1	10
Cadmium	1	468	09/07/01	NF	1	1	0.04	—	—	—	—	—
Cadmium	1	468	09/07/01	NF	1	1	0.12	—	—	—	—	—

Table A-28 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Frequency of Detects > Drinking Water MCL ^b (µg/L)	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Calcium	1	468	09/07/01	F	1	1	3030	—	—	—	—
Calcium	1	468	09/07/01	NF	1	1	3520	—	—	—	—
Chloride	1	468	09/07/01	F	2	2	10100	—	250000	0/2	250000
Chromium	1	468	09/07/01	F	1	0	—	[0.57]	100	0/1	50
Chromium	1	468	09/07/01	NF	1	1	6.33	—	—	—	—
Cobalt	1	468	09/07/01	F	1	0	—	[0.737]	—	—	50
Cobalt	1	468	09/07/01	NF	1	0	—	[0.737]	—	—	—
Copper	1	468	09/07/01	F	1	1	6.49	—	1300	0/1	1000
Copper	1	468	09/07/01	NF	1	1	12	—	—	—	—
Cyanide (total)	1	468	09/07/01	NF	1	0	—	[2.89]	—	—	—
Fluoride	1	468	09/07/01	F	1	1	557	—	4000	0/1	1600
Iron	1	468	09/07/01	F	1	1	109	—	300	0/1	1000
Iron	1	468	09/07/01	NF	1	1	521	—	—	—	—
Lead	1	468	09/07/01	F	1	1	5.83	—	15	0/1	50
Lead	1	468	09/07/01	NF	1	1	8.34	—	—	—	—
Magnesium	1	468	09/07/01	F	1	1	569	—	—	—	—
Magnesium	1	468	09/07/01	NF	1	1	746	—	—	—	—
Manganese	1	468	09/07/01	F	1	1	54.8	—	50	1/1	200
Manganese	1	468	09/07/01	NF	1	1	94.6	—	—	—	—
Mercury	1	468	09/07/01	F	1	0	—	[0.064]	2	0/1	—
Mercury	1	468	09/07/01	NF	1	0	—	[0.064]	—	—	2
Molybdenum	1	468	09/07/01	F	1	1	21.7	—	—	—	—
Molybdenum	1	468	09/07/01	NF	1	1	22.3	—	—	—	—
Nickel	1	468	09/07/01	F	1	1	2.34	—	100	0/1	200
Nickel	1	468	09/07/01	NF	1	1	6.71	—	—	—	—
Nitrate + Nitrite (as N)	1	468	09/07/01	F	1	1	30	—	10000	0/1	—
Potassium	1	468	09/07/01	F	1	1	1510	—	—	—	—

Table A-28 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Frequency of Detects > Drinking Water MCL ^b (µg/L)	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Potassium	1	468	09/07/01	NF	1	1	1610	—	—	—	—
Selenium	1	468	09/07/01	F	1	0	—	[3.49]	50	0/1	0/1
Selenium	1	468	09/07/01	NF	1	0	—	[3.49]	—	—	—
Silicon Dioxide	1	468	09/07/01	F	1	1	12283.6	—	—	—	—
Silicon Dioxide	1	468	09/07/01	NF	1	1	13674.6	—	—	—	—
Silver	1	468	09/07/01	F	1	0	—	[0.666]	100	0/1	50
Silver	1	468	09/07/01	NF	1	0	—	[0.666]	—	—	—
Sodium	1	468	09/07/01	F	1	1	25600	—	—	—	—
Sodium	1	468	09/07/01	NF	1	1	25300	—	—	—	—
Lab Specific Conductance	1	468	09/07/01	F	1	1	75	—	—	—	—
Strontrium	1	468	09/07/01	F	1	1	13.9	—	—	—	—
Strontrium	1	468	09/07/01	NF	1	1	16.5	—	—	—	—
Sulfate	1	468	09/07/01	F	1	1	301	—	250000	0/1	600000
Thallium	1	468	09/07/01	F	1	0	—	[0.021]	2	0/1	—
Thallium	1	468	09/07/01	NF	1	0	—	[0.021]	—	—	—
Total Kjeldahl Nitrogen	1	468	09/07/01	F	1	1	3900	—	—	—	—
Phosphorus (total)	1	468	09/07/01	F	1	1	440	—	—	—	—
Uranium	1	468	09/07/01	F	1	0	—	[0.003]	20	0/1	5000
Uranium	1	468	09/07/01	NF	1	0	—	[0.003]	—	—	—
Vanadium	1	468	09/07/01	F	1	1	0.49	—	—	—	—
Vanadium	1	468	09/07/01	NF	1	1	0.682	—	—	—	—
Zinc	1	468	09/07/01	F	1	0	—	[1.76]	5000	0/1	10000
Zinc	1	468	09/07/01	NF	1	1	5.91	—	—	—	—

Table A-28 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Stable Isotope (%)												
δD	1	468	09/07/01	NF	1	1	-79	—	—	—	—	—
δ ¹⁵ N – NH ₄	1	468	09/07/01	NF	1	1	-6.2	—	—	—	—	—
δ ¹⁵ N – NO ₃	1	468	09/07/01	NF	1	1	SV ⁱ	—	—	—	—	—
δ ¹⁸ O	1	468	09/07/01	NF	1	1	-11.5	—	—	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.^c NMED = New Mexico Environment Department.^d State of New Mexico groundwater standards are from *New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection*, 20 NMAC 6.2.^e NF = Nonfiltered.^f — = Not available or not applicable.^g NTU = Nephelometric turbidity unit.^h F = Filtered.ⁱ ISV = Insufficient sample volume.

Table A-29
Regional Well R-12 Screen 2 Fourth Round Sample Results: Data Summary for Inorganic Chemicals

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Field Parameter												
Field Alkalinity (total as CaCO ₃)	2	507	09/10/01	NF ^e	1	1	_ ^f	—	—	—	—	—
pH	2	507	09/10/01	NF	1	1	9.26	—	>6 & <9	0/1	>6 & <9	0/1
Specific Conductance (µS/cm)	2	507	09/10/01	NF	1	1	156.4	—	—	0/1	—	0/1
Temperature (°C)	2	507	09/10/01	NF	1	1	24.4	—	—	0/1	—	0/1
Turbidity (NTU ^g)	2	507	09/10/01	NF	1	1	2.5	—	—	0/1	—	0/1
Analyte												
Lab Alkalinity (as CaCO ₃)	2	507	09/10/01	F ^h	1	1	53000	—	—	—	—	—
Aluminum	2	507	09/10/01	F	1	0	[9.54]	50	0/1	5000	0/1	—
Aluminum	2	507	09/10/01	NF	1	0	[9.54]	—	—	—	—	—
Ammonia	2	507	09/10/01	F	1	1	270	—	—	—	—	—
Antimony	2	507	09/10/01	F	1	0	[0.09]	6	0/1	—	—	—
Antimony	2	507	09/10/01	NF	1	0	[0.07]	—	—	—	—	—
Arsenic	2	507	09/10/01	F	1	0	[2.6]	50	0/1	100	0/1	—
Arsenic	2	507	09/10/01	NF	1	1	3.18	—	—	—	—	—
Barium	2	507	09/10/01	F	1	1	12.8	—	2000	0/1	1000	0/1
Barium	2	507	09/10/01	NF	1	1	14.2	—	—	—	—	—
Beryllium	2	507	09/10/01	F	1	0	[0.003]	4	0/1	—	—	—
Beryllium	2	507	09/10/01	NF	1	0	[0.003]	—	—	—	—	—
Boron	2	507	09/10/01	F	1	0	[37.1]	—	—	750	0/1	—
Boron	2	507	09/10/01	NF	1	0	[35.1]	—	—	—	—	—
Bromide	2	507	09/10/01	F	2	0	[20]	—	—	—	—	—
Cadmium	2	507	09/10/01	F	1	0	[0.017]	5	0/1	10	0/1	—
Cadmium	2	507	09/10/01	NF	1	1	0.04	—	—	—	—	—

Table A-29 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Calcium	2	507	09/10/01	F	1	1	15000	—	—	—	—
Calcium	2	507	09/10/01	NF	1	1	14800	—	—	—	—
Chloride	2	507	09/10/01	F	2	2	4380	—	250000	0/2	250000
Chromium	2	507	09/10/01	F	1	0	—	[0.57]	100	0/1	0/2
Chromium	2	507	09/10/01	NF	1	0	—	[0.57]	—	50	0/1
Cobalt	2	507	09/10/01	F	1	0	—	[0.737 to 0.737]	—	—	—
Cobalt	2	507	09/10/01	NF	1	0	—	[0.737]	—	—	—
Copper	2	507	09/10/01	F	1	0	—	[1.02]	1300	0/1	1000
Copper	2	507	09/10/01	NF	1	1	1.42	—	—	—	—
Cyanide (total)	2	507	09/10/01	NF	1	0	—	[2.89]	—	—	—
Fluoride	2	507	09/10/01	F	1	1	404	—	4000	0/1	1600
Iron	2	507	09/10/01	F	1	0	—	[2.24]	300	0/1	1000
Iron	2	507	09/10/01	NF	1	0	—	[2.24]	—	—	—
Lead	2	507	09/10/01	F	1	0	—	[0.011]	15	0/1	50
Lead	2	507	09/10/01	NF	1	0	—	[0.011]	—	—	—
Magnesium	2	507	09/10/01	F	1	1	1900	—	—	—	—
Magnesium	2	507	09/10/01	NF	1	1	2040	—	—	—	—
Manganese	2	507	09/10/01	F	1	1	43.5	—	50	0/1	200
Manganese	2	507	09/10/01	NF	1	1	56.5	—	—	—	—
Mercury	2	507	09/10/01	F	1	0	—	[0.064]	2	0/1	—
Mercury	2	507	09/10/01	NF	1	0	—	[0.064]	—	—	—
Molybdenum	2	507	09/10/01	F	1	1	7.12	—	—	—	—
Molybdenum	2	507	09/10/01	NF	1	1	7.33	—	—	—	—
Nickel	2	507	09/10/01	F	1	0	—	[1.26]	100	0/1	200
Nickel	2	507	09/10/01	NF	1	0	—	[1.26]	—	—	—
Nitrate + Nitrite (as N)	2	507	09/10/01	F	1	1	70	—	10000	0/1	—

Table A-29 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Potassium	2	507	09/10/01	F	1	1	1980	—	—	—	—
Potassium	2	507	09/10/01	NF	1	1	1920	—	—	—	—
Selenium	2	507	09/10/01	F	1	0	—	[3.49]	50	0/1	0/1
Selenium	2	507	09/10/01	NF	1	0	—	[3.49]	—	—	—
Silica	2	507	09/10/01	F	1	1	31030	—	—	—	—
Silica	2	507	09/10/01	NF	1	1	31886	—	—	—	—
Silver	2	507	09/10/01	F	1	0	—	[0.666]	100	0/1	50
Silver	2	507	09/10/01	NF	1	0	—	[0.666]	—	—	—
Sodium	2	507	09/10/01	F	1	1	11100	—	—	—	—
Sodium	2	507	09/10/01	NF	1	0	—	[11100]	—	—	—
Lab Specific Conductance	2	507	09/10/01	F	1	1	134	—	—	—	—
Strontrium	2	507	09/10/01	F	1	1	58.3	—	—	—	—
Strontrium	2	507	09/10/01	NF	1	1	58.9	—	—	—	—
Sulfate	2	507	09/10/01	F	1	1	7650	—	250000	0/1	600000
Thallium	2	507	09/10/01	F	1	0	—	[0.021]	2	0/1	—
Thallium	2	507	09/10/01	NF	1	0	—	[0.021]	—	—	—
Total Kjeldahl Nitrogen	2	507	09/10/01	F	1	1	490	—	—	—	—
Phosphorus (total)	2	507	09/10/01	F	1	1	90	—	—	—	—
Uranium	2	507	09/10/01	F	1	1	0.14	—	20	0/1	5000
Uranium	2	507	09/10/01	NF	1	1	0.16	—	—	—	—
Vanadium	2	507	09/10/01	F	1	1	2.63	—	—	—	—
Vanadium	2	507	09/10/01	NF	1	1	2.45	—	—	—	—
Zinc	2	507	09/10/01	F	1	0	—	[1.63]	5000	0/1	10000
Zinc	2	507	09/10/01	NF	1	0	—	[2.02]	—	—	—

Table A-29 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Stable Isotope (%)												
δD	2	507	09/10/01	NF	1	1	-82	—	—	—	—	—
$\delta^{15}\text{N} - \text{NH}_4$	2	507	09/10/01	NF	1	1	ISV ⁱ	—	—	—	—	—
$\delta^{15}\text{N} - \text{NO}_3$	2	507	09/10/01	NF	1	1	+10.2	—	—	—	—	—
$\delta^{18}\text{O}$	2	507	09/10/01	NF	1	1	-11.5	—	—	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.^c NMED = New Mexico Environment Department.^d State of New Mexico groundwater standards are from *New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection*, 20 NMAC 6.2.^e NF = Nonfiltered.^f — = Not available or not applicable.^g NTU = Nephelometric turbidity unit.^h F = Filtered.ⁱ ISV = Insufficient sample volume.

Table A-30
Regional Well R-12 Screen 3 Fourth Round Sample Results: Data Summary for Inorganic Chemicals

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Field Parameter												
Field Alkalinity (total as CaCO ₃)	3	811	09/12/01	NF ^e	1	1	— ^f	—	—	—	—	—
pH	3	811	09/12/01	NF	1	1	7.57	—	>6 & <9	0/1	>6 & <9	0/1
Specific Conductance (µS/cm)	3	811	09/12/01	NF	1	1	388.4	—	—	0/1	—	0/1
Temperature (°C)	3	811	09/12/01	NF	1	1	25.8	—	—	0/1	—	0/1
Turbidity (NTU ^g)	3	811	09/12/01	NF	1	1	5.0	—	—	0/1	—	0/1
Analyte												
Lab Alkalinity (total as CaCO ₃)	3	811	09/12/01	NF ^e	1	1	91000	—	—	—	—	—
Arsenic	3	811	09/12/01	NF	1	0	—	[2.6]	—	—	—	—
Barium	3	811	09/12/01	F ^h	1	1	145	—	2000	0/1	1000	0/1
Barium	3	811	09/12/01	NF	1	1	151	—	—	—	—	—
Beryllium	3	811	09/12/01	F	1	0	—	[0.003]	4	0/1	—	—
Beryllium	3	811	09/12/01	NF	1	1	0.02	—	—	—	—	—
Boron	3	811	09/12/01	F	1	0	—	[72.7]	—	—	750	0/1
Boron	3	811	09/12/01	NF	1	0	—	[75.9]	—	—	—	—
Bromide	3	811	09/12/01	F	2	0	—	[20]	—	—	—	—
Cadmium	3	811	09/12/01	F	1	0	—	[0.017]	5	0/1	10	0/1
Cadmium	3	811	09/12/01	NF	1	1	0.04	—	—	—	—	—
Calcium	3	811	09/12/01	F	1	1	44000	—	—	—	—	—
Calcium	3	811	09/12/01	NF	1	1	45300	—	—	—	—	—
Chloride	3	811	09/12/01	F	2	2	8810	—	250000	0/2	250000	0/2
Chromium	3	811	09/12/01	F	1	0	—	[0.57]	100	0/1	50	0/1
Chromium	3	811	09/12/01	NF	1	1	1.06	—	—	—	—	—
Cobalt	3	811	09/12/01	F	1	0	—	[0.737]	—	—	50	0/1

Table A-30 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value ($\mu\text{g/L}$)	Non-detected Value ($\mu\text{g/L}$)	Drinking Water MCL ^b ($\mu\text{g/L}$)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d ($\mu\text{g/L}$)	Frequency of Detects > NMED Groundwater Standard
Cobalt	3	811	09/12/01	NF	1	0	—	[0.737]	—	—	1000	0/1
Copper	3	811	09/12/01	F	1	0	—	[1.02]	1300	0/1	—	—
Cyanide (total)	3	811	09/12/01	NF	1	0	—	[1.02]	—	—	—	—
Fluoride	3	811	09/12/01	F	1	1	367	—	4000	0/1	1600	0/1
Iron	3	811	09/12/01	F	1	0	—	[2.24]	300	0/1	1000	0/1
Iron	3	811	09/12/01	NF	1	1	372	—	—	—	—	—
Lead	3	811	09/12/01	F	1	0	—	[0.011]	15	0/1	50	0/1
Magnesium	3	811	09/12/01	F	1	1	10400	—	—	—	—	—
Magnesium	3	811	09/12/01	NF	1	1	10800	—	—	—	—	—
Manganese	3	811	09/12/01	F	1	1	340	—	50	1/1	200	1/1
Manganese	3	811	09/12/01	NF	1	1	360	—	—	—	—	—
Mercury	3	811	09/12/01	F	1	0	—	[0.064]	2	0/1	—	—
Molybdenum	3	811	09/12/01	F	1	1	5.92	—	—	—	—	—
Molybdenum	3	811	09/12/01	NF	1	1	6.02	—	—	—	—	—
Nickel	3	811	09/12/01	F	1	1	4.8	—	100	0/1	200	0/1
Nickel	3	811	09/12/01	NF	1	1	5.15	—	—	—	—	—
Nitrate + Nitrite (as N)	3	811	09/12/01	F	1	1	10	—	10000	0/1	—	—
Potassium	3	811	09/12/01	F	1	1	4280	—	—	—	—	—
Potassium	3	811	09/12/01	NF	1	1	4450	—	—	—	—	—
Selenium	3	811	09/12/01	F	1	0	—	[3.49]	50	0/1	50	0/1
Selenium	3	811	09/12/01	NF	1	0	—	[3.49]	—	—	—	—
Silica	3	811	09/12/01	F	1	1	57780	—	—	—	—	—
Silica	3	811	09/12/01	NF	1	1	59064	—	—	—	—	—
Silver	3	811	09/12/01	F	1	0	—	[0.666]	100	0/1	50	0/1
Silver	3	811	09/12/01	NF	1	0	—	[0.666]	—	—	—	—

Table A-30 (continued)

Parameter and Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (µg/L)	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMED Groundwater Standard ^c (µg/L)	Frequency of Detects > NMED Groundwater Standard
Sodium	3	811	09/12/01	F	1	1	18300	—	—	—	—	—
Sodium	3	811	09/12/01	NF	1	1	19100	—	—	—	—	—
Lab Specific Conductance	3	811	09/12/01	F	1	1	358	—	—	—	—	—
Strontium	3	811	09/12/01	F	1	1	231	—	—	—	—	—
Strontium	3	811	09/12/01	NF	1	1	238	—	—	—	—	—
Sulfate	3	811	09/12/01	F	1	1	13400	—	250000	0/1	600000	0/1
Thallium	3	811	09/12/01	F	1	0	—	[0.021]	2	0/1	—	—
Thallium	3	811	09/12/01	NF	1	0	—	[0.021]	—	—	—	—
Total Kjeldahl Nitrogen	3	811	09/12/01	F	1	1	300	—	—	—	—	—
Phosphorus (total)	3	811	09/12/01	F	1	1	50	—	—	—	—	—
Uranium	3	811	09/12/01	F	1	1	1.94	—	20	0/1	5000	0/1
Uranium	3	811	09/12/01	NF	1	1	1.85	—	—	—	—	—
Vanadium	3	811	09/12/01	F	1	1	2.3	—	—	—	—	—
Vanadium	3	811	09/12/01	NF	1	1	1.22	—	—	—	—	—
Zinc	3	811	09/12/01	F	1	0	—	[2.73]	5000	0/1	10000	0/1
Zinc	3	811	09/12/01	NF	1	1	5.43	—	—	—	—	—

Table A-30 (continued)

Parameter and Analyte	Screen Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Non-detected Value (µg/L)	Drinking Water MCL ^b (µg/L)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d (µg/L)	Frequency of Detects > NMED Groundwater Standard
Stable Isotope (‰)										
δD	3	811	09/12/01	NF	1	1	-74	—	—	—
δ ¹⁵ N – NH ₄	3	811	09/12/01	NF	1	1	—	ISV ⁱ	—	—
δ ¹⁵ N – NO ₃	3	811	09/12/01	NF	1	1	—	ISV	—	—
δ ¹⁸ O	3	811	09/12/01	NF	1	1	-10.8	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from *National Primary Drinking Water Regulations*, 40 CFR Part 141. US EPA secondary MCLs are from *National Secondary Drinking Water Regulations*, 40 CFR Part 143. State of New Mexico MCLs are from *Drinking Water Regulations*, 20 NMAC 7.1.^c NMED = New Mexico Environment Department.^d State of New Mexico groundwater standards are from *New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection*, 20 NMAC 6.2.^e NF = Nonfiltered.^f — = Not available or not applicable.^g NTU = Nephelometric turbidity unit.^h F = Filtered.ⁱ ISV = Insufficient sample volume.

Table A-31
Regional Well R-12 Screen 1 Fourth Round Sample Results: Data Summary for Detected Organic Chemicals

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value ($\mu\text{g/L}$)	Non-detected Value ($\mu\text{g/L}$)	Frequency of Detects > Drinking Water MCL	NMEDc Groundwater Standard ^d ($\mu\text{g/L}$)	Frequency of Detects > NMED Groundwater Standard
Butanone[2-]	1	468	09/07/01	NF ^e	1	1	1.1	— ^f	—	—	—
Dissolved Organic Carbon	1	468	09/07/01	F ^g	1	1	5000	—	—	—	—
Humic Substances, Hydrophilic Acids	1	468	09/07/01	F	1	1	1200	—	—	—	—
Humic Substances, Hydrophilic Bases	1	468	09/07/01	F	1	1	300	—	—	—	—
Humic Substances, Hydrophilic Neutrals	1	468	09/07/01	F	1	1	100	—	—	—	—
Humic Substances, Hydrophilic Total	1	468	09/07/01	F	1	1	1600	—	—	—	—
Humic Substances, Hydrophobic Acids	1	468	09/07/01	F	1	1	2100	—	—	—	—
Humic Substances, Hydrophobic Bases	1	468	09/07/01	F	1	1	0	—	—	—	—
Humic Substances, Hydrophobic Neutrals	1	468	09/07/01	F	1	1	1200	—	—	—	—
Hydrophobic Total	1	468	09/07/01	F	1	1	3300	—	—	—	—
Methylene Chloride	1	468	09/07/01	NF	1	1	1.1	—	5	0/1	100/0/1
Total Organic Carbon	1	468	09/07/01	NF	1	1	9990	—	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.

^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from National Primary Drinking Water Regulations, 40 CFR Part 141. US EPA secondary MCLs are from National Secondary Drinking Water Regulations, 40 CFR Part 143. State of New Mexico MCLs are from Drinking Water Regulations, 20 NMAC 7.1.

^c NMED = New Mexico Environment Department.

^d State of New Mexico groundwater standards are from New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection, 20 NMAC 6.2.

^e NF = Nonfiltered.
^f — = Not available or not applicable.

^g F = Filtered.

Table A-32
Regional Well R-12 Screen 2 Fourth Round Sample Results: Data Summary for Detected Organic Chemicals

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value ($\mu\text{g/L}$)	Non-detected Value ($\mu\text{g/L}$)	Frequency of Detects > Drinking Water MCL	NMED ^c Groundwater Standard ^d ($\mu\text{g/L}$)	Frequency of Detects > NMED Groundwater Standard
Acetone	2	507	09/10/01	NF ^e	1	1	19.1	— ^f	—	—	—
Dissolved Organic Carbon	2	507	09/10/01	F ^g	1	1	1800	—	—	—	—
Humic Substances, Hydrophilic Acids	2	507	09/10/01	F	1	1	500	—	—	—	—
Humic Substances, Hydrophilic Bases	2	507	09/10/01	F	1	1	100	—	—	—	—
Humic Substances, Hydrophilic Neutrals	2	507	09/10/01	F	1	1	200	—	—	—	—
Humic Substances, Hydrophilic Total	2	507	09/10/01	F	1	1	800	—	—	—	—
Humic Substances, Hydrophobic Acids	2	507	09/10/01	F	1	1	400	—	—	—	—
Humic Substances, Hydrophobic Bases	2	507	09/10/01	F	1	1	0	—	—	—	—
Humic Substances, Hydrophobic Neutrals	2	507	09/10/01	F	1	1	600	—	—	—	—
Humic Substances, Hydrophobic Total	2	507	09/10/01	F	1	1	1000	—	—	—	—
Total Organic Carbon	2	507	09/10/01	NF	1	1	1770	—	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from National Primary Drinking Water Regulations, 40 CFR Part 141. US EPA secondary MCLs are from National Secondary Drinking Water Regulations, 40 CFR Part 143. State of New Mexico MCLs are from Drinking Water Regulations, 20 NMAC 7.1.^c NMED = New Mexico Environment Department.^d State of New Mexico groundwater standards are from New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection, 20 NMAC 6.2.^e NF = Nonfiltered.^f — = Not available or not applicable.^g F = Filtered.

**Table A-33
Regional Well R-12 Screen 3 Fourth Round Sample Results: Data Summary for Detected Organic Chemicals**

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value ($\mu\text{g/L}$)	Non-detected Value ($\mu\text{g/L}$)	Frequency of Detects > NMEDc Groundwater Standard	NMEDc Groundwater Standard ^d ($\mu\text{g/L}$)	Frequency of Detects > NMED Groundwater Standard
Acetone	3	811	09/12/01	NF ^e	1	1	2.4	— ^f	—	—	—
Dissolved Organic Carbon	3	811	09/12/01	F ^g	1	1	1100	—	—	—	—
Humic Substances, Hydrophilic Acids	3	811	09/12/01	F	1	1	300	—	—	—	—
Humic Substances, Hydrophilic Bases	3	811	09/12/01	F	1	1	0	—	—	—	—
Humic Substances, Hydrophilic Neutrals	3	811	09/12/01	F	1	1	200	—	—	—	—
Humic Substances, Hydrophilic Total	3	811	09/12/01	F	1	1	500	—	—	—	—
Humic Substances, Hydrophobic Acids	3	811	09/12/01	F	1	1	200	—	—	—	—
Humic Substances, Hydrophobic Bases	3	811	09/12/01	F	1	1	0	—	—	—	—
Humic Substances, Hydrophobic Neutrals	3	811	09/12/01	F	1	1	400	—	—	—	—
Humic Substances, Hydrophobic Total	3	811	09/12/01	F	1	1	600	—	—	—	—
Total Organic Carbon	3	811	09/12/01	NF	1	1	352	—	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.

^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from National Primary Drinking Water Regulations, 40 CFR Part 141. US EPA secondary MCLs are from National Secondary Drinking Water Regulations, 40 CFR Part 143. State of New Mexico MCLs are from Drinking Water Regulations, 20 NMAC 7.1.

^c NMED = New Mexico Environment Department.

^d State of New Mexico groundwater standards are from New Mexico Water Quality Control Commission Regulations, Ground and Surface Water Protection, 20 NMAC 6.2.

^e NF = Nonfiltered.

^f — = Not available or not applicable.

^g F = Filtered.

Table A-34
Regional Well R-12 Screen 1 Fourth Round Sample Results: Data Summary for Radionuclides

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (pCi/L)	Nondetected Value (pCi/L)	Drinking Water MCL ^b (pCi/L)	Frequency of Detects > Drinking Water MCL
Americium-241	1	468	09/07/01	F ^c	1	0	— ^d	[0.0122]	15 ^e	0/2
Cesium-134	1	468	09/07/01	F	1	0	—	[2.5]	—	—
Cesium-137	1	468	09/07/01	F	1	0	—	[0.538]	—	—
Cobalt-60	1	468	09/07/01	F	1	0	—	[1.42]	—	—
Europium-152	1	468	09/07/01	F	1	0	—	[0.605]	—	—
Gross Alpha Radiation	1	468	09/07/01	NF ^f	1	0	—	[0.219]	—	—
Gross Beta Radiation	1	468	09/07/01	NF	1	1	3.93	—	—	—
Gross Gamma Radiation	1	468	09/07/01	NF	1	0	—	[87.4]	—	—
Plutonium-238	1	468	09/07/01	F	1	0	—	[0.00067]	15 ^e	0/1
Plutonium-239	1	468	09/07/01	F	1	0	—	[0.000669]	15 ^e	0/1
Ruthenium-106	1	468	09/07/01	F	1	0	—	[12.6]	—	—
Strontrium-90	1	468	09/07/01	F	1	0	—	[0.238]	8	0/1
Tritium	1	468	09/07/01	NF	1	1	181.04	—	20000	0/1
Uranium-234	1	468	09/07/01	F	1	1	0.0228	—	—	—
Uranium-235	1	468	09/07/01	F	1	0	—	[0]	—	—
Uranium-238	1	468	09/07/01	F	1	1	0.0185	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.

^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from National Primary Drinking Water Regulations, 40 CFR Part 141. US EPA secondary MCLs are from National Secondary Drinking Water Regulations, 40 CFR Part 143. State of New Mexico MCLs are from Drinking Water Regulations, 20 NMAC 7.1.

^c F = Filtered.

^d — = Not available or not applicable.

^e Based on an MCL of 15 pCi/L (including radium-226, but excluding radon and uranium).
^f NF = Nonfiltered.

Table A-35
Regional Well R-12 Screen 2 Fourth Round Sample Results: Data Summary for Radionuclides

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (pCi/L)	Nondetected Value (pCi/L)	Drinking Water MCL ^b (pCi/L)	Frequency of Detects > Drinking Water MCL
Americium-241	2	507	09/10/01	F ^c	1	0	— ^d	[0.00896]	15 ^e	0/2
Cesium-134	2	507	09/10/01	F	1	0	—	[0.593]	—	—
Cesium-137	2	507	09/10/01	F	1	0	—	[0.0189]	—	—
Cobalt-60	2	507	09/10/01	F	1	0	—	[0.507]	—	—
Europium-152	2	507	09/10/01	F	1	0	—	[1.64]	—	—
Gross Alpha Radiation	2	507	09/10/01	NF ^f	1	1	0.71	—	—	—
Gross Beta Radiation	2	507	09/10/01	NF	1	0	—	[2.44]	—	—
Gross Gamma Radiation	2	507	09/10/01	NF	1	0	—	[3.04]	—	—
Plutonium-238	2	507	09/10/01	F	1	0	—	[0.000314]	15 ^e	0/1
Plutonium-239	2	507	09/10/01	F	1	0	—	[0.00188]	15 ^e	0/1
Ruthenium-106	2	507	09/10/01	F	1	0	—	[5.18]	—	—
Strontrium-90	2	507	09/10/01	F	1	0	—	[0.267]	8	0/1
Tritium	2	507	09/10/01	NF	1	1	78.23	—	20000	0/1
Uranium-234	2	507	09/10/01	F	1	1	0.169	—	—	—
Uranium-235	2	507	09/10/01	F	1	0	—	[0.00751]	—	—
Uranium-238	2	507	09/10/01	F	1	1	0.0966	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.

^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from National Primary Drinking Water Regulations, 40 CFR Part 141. US EPA secondary MCLs are from National Secondary Drinking Water Regulations, 40 CFR Part 143. State of New Mexico MCLs are from Drinking Water Regulations, 20 NMAC 7.1.

^c F = Filtered.

^d — = Not available or not applicable.

^e Based on an MCL of 15 pCi/L (including radium-226, but excluding radon and uranium).

^f NF = Nonfiltered.

Table A-36
Regional Well R-12 Screen 3 Fourth Round Sample Results: Data Summary for Radionuclides

Analyte	Screen	Depth (ft) ^a	Collection Date	Field Preparation	Number of Analyses	Number of Detects	Detected Value (pCi/L)	Nondetected Value (pCi/L)	Drinking Water MCL ^b (pCi/L)	Frequency of Detects > Drinking Water MCL
Americium-241	3	811	09/12/01	F ^c	1	0	— ^d	[0.00746]	15 ^e	0/2
Cesium-134	3	811	09/12/01	F	1	0	—	[-0.0842]	—	—
Cesium-137	3	811	09/12/01	F	1	0	—	[2.19]	—	—
Cobalt-60	3	811	09/12/01	F	1	0	—	[2.55]	—	—
Europium-152	3	811	09/12/01	F	1	0	—	[5.49]	—	—
Gross Alpha Radiation	3	811	09/12/01	NF ^f	1	1	2.21	—	—	—
Gross Beta Radiation	3	811	09/12/01	NF	1	1	5.98	—	—	—
Gross Gamma Radiation	3	811	09/12/01	NF	1	0	—	[1.91]	—	—
Plutonium-238	3	811	09/12/01	F	1	0	—	[0.00233]	15 ^e	0/1
Plutonium-239	3	811	09/12/01	F	1	0	—	[0.00494]	15 ^e	0/1
Ruthenium-106	3	811	09/12/01	F	1	0	—	[3.46]	—	—
Srtronium-90	3	811	09/12/01	F	1	0	—	[0.165]	8	0/1
Tritium	3	811	09/12/01	NF	1	1	49.81	—	20000	0/1
Uranium-234	3	811	09/12/01	F	1	1	1.33	—	—	—
Uranium-235	3	811	09/12/01	F	1	1	—	[12.6]	—	—
Uranium-238	3	811	09/12/01	F	1	1	0.7	—	—	—

^a The static water level for the regional aquifer at R-12 is 805 ft.

^b MCL = Maximum contaminant level. US Environmental Protection Agency (EPA) MCLs are from National Primary Drinking Water Regulations, 40 CFR Part 141. US EPA secondary MCLs are from National Secondary Drinking Water Regulations, 40 CFR Part 143. State of New Mexico MCLs are from Drinking Water Regulations, 20 NMAC 7.1.

^c F = Filtered.

^d — = Not available or not applicable.

^e Based on an MCL of 15 pCi/L (including radium-226, but excluding radon and uranium).

^f NF = Nonfiltered.

Appendix B

*Geochemical Calculations
(Input Files for the Computer Program MINTEQA2)*

A description of the input file for the computer program MINTEQA2 (Allison et al. 1991, 49930) is provided below.

Rows one and two (blank) consist of the title for the calculations.

Row three consists of temperature, units of concentration, and calculation of ionic strength.

Row four is blank.

Row five consists of query for charge balance termination (>30%); alkalinity or inorganic carbon as carbonate; query for oversaturated solids that are not allowed to precipitate excluding infinite and finite phases; maximum number of iterations (40, 100, and 200); selection for calculating activity coefficient (Davies equation); level of output; pH; Eh or pe; and a query for choosing a different file to modify or return to output filename prompt.

Row six is blank.

Row seven contains zeros (not specific to input file).

Row eight is blank.

Rows nine through 25 contains species number, concentration, log base 10 activity, a prompt (y) for refining calculation of activity for each species, and the chemical symbol for each species.

Row 26 is blank.

Row 27 consists of pH input (measured)

Row 28 consists of pH including its species number, pH value, and chemical symbol.

Row 29 includes excluded species for calculation

Row 30 consists of excluded species identification number, log base 10 association constant (K) and delta H (enthalpy) for association constant. Species U(OH)₅⁻ was excluded from calculations because spectroscopic data did not confirm its occurrence in aqueous solution (Langmuir 1997, 56037).

GEOCHEMICAL CALCULATIONS FOR R-12 (468 FT).

SAMPLED ON 09/18/00.

21.80 MG/L 0.000 0.00000E-01

1 0 1 0 3 0 0 0 1 1 0 0 0

0 0 0

330	0.000E-01	-8.01	y	/H+1
140	1.019E+02	-5.10	y	/Total CO ₃ -2 alkali
150	3.000E+01	-3.13	y	/Ca+2
460	9.000E+00	-3.43	y	/Mg+2
500	2.600E+01	-2.95	y	/Na+1
410	4.500E+00	-3.94	y	/K+1
180	1.600E+01	-3.35	y	/Cl-1
770	5.460E+01	-3.25	y	/H ₄ SiO ₄
732	3.600E+00	-4.43	y	/SO ₄ -2
490	1.410E+00	-4.11	y	/NH ₄ +1
100	3.800E-02	-6.56	y	/Ba+2
270	5.200E-01	-4.56	y	/F-1
470	8.600E-01	-4.81	y	/Mn+2
540	5.100E-03	-7.06	y	/Ni+2
800	1.300E-01	-5.83	y	/Sr+2
891	9.300E-04	-8.41	y	/U+4

3 1

330 8.0100 0.0000 /H+1

6 1

8913304 -13.1200 30.2450 /U(OH)₅ -1

GEOCHEMICAL CALCULATIONS FOR R-12 (468 FT).

SAMPLED ON 03/14/01.

13.20 MG/L 0.000 0.00000E-01

1 0 1 0 3 0 0 0 1 1 0 0 0

0 0 0

330	0.000E-01	-6.91	y	/H+1
140	7.194E+01	-19.60	y	/Total CO ₃ -2 alkali
150	1.500E+01	-3.43	y	/Ca+2
460	4.300E+00	-3.75	y	/Mg+2
500	2.600E+01	-2.95	y	/Na+1
410	3.300E+00	-4.07	y	/K+1
180	1.300E+01	-3.44	y	/Cl-1
770	66.70E+01	-3.16	y	/H ₄ SiO ₄
732	5.000E-01	-5.28	y	/SO ₄ -2
490	2.060E+00	-3.94	y	/NH ₄ +1
100	4.800E-02	-6.46	y	/Ba+2
270	6.800E-01	-4.45	y	/F-1
280	6.000E-01	-4.97	y	/Fe+2
470	7.200E-01	-4.88	y	/Mn+2
540	9.000E-04	-7.81	y	/Ni+2
492	1.010E+00	-4.79	y	/NO ₃ -1
800	7.100E-02	-6.09	y	/Sr+2
891	6.000E-05	-9.60	y	/U+4

3 1

330 6.9100 0.0000 /H+1

6 1

8913304 -13.1200 30.2450 /U(OH)₅ -1

GEOCHEMICAL CALCULATIONS FOR R-12 (468 FT).

SAMPLED ON 06/13/01.

19.90 MG/L 0.000 0.00000E-01

1 0 1 0 3 0 0 0 1 1 0 0 0

0 0 0

330	0.000E-01	-8.63	y	/H+1
140	4.257E+01	-19.83	y	/Total CO ₃ -2 alkali
150	4.800E+00	-3.92	y	/Ca+2
460	1.200E+00	-4.31	y	/Mg+2
500	2.100E+01	-3.04	y	/Na+1
410	2.200E+00	-4.25	y	/K+1
180	1.200E+01	-3.47	y	/Cl-1
770	4.110E+01	-3.37	y	/H ₄ SiO ₄
732	5.000E-01	-5.28	y	/SO ₄ -2
490	4.000E+00	-3.65	y	/NH ₄ +1
100	3.100E-02	-6.65	y	/Ba+2
270	5.100E-01	-4.57	y	/F-1
470	2.000E-01	-5.44	y	/Mn+2
800	2.500E-02	-6.54	y	/Sr+2
580	1.350E+00	-4.85	y	/PO ₄ -3
891	3.000E-05	-9.90	y	/U+4

3 1

330 8.6300 0.0000 /H+1

6 1

8913304 -13.1200 30.2450 /U(OH)5 -1

GEOCHEMICAL CALCULATIONS FOR R-12 (468 FT).

SAMPLED ON 09/07/01.

21.30 MG/L 0.000 0.00000E-01

1 0 1 0 3 0 0 0 1 1 0 0 0

0 0 0

330	0.000E-01	-8.94	y	/H+1
140	3.177E+01	-19.96	y	/Total CO ₃ -2 alkali
150	3.000E+00	-4.13	y	/Ca+2
460	6.000E-01	-4.61	y	/Mg+2
500	2.560E+01	-2.95	y	/Na+1
410	1.500E+00	-4.42	y	/K+1
180	1.010E+01	-3.55	y	/Cl-1
770	4.210E+01	-3.36	y	/H ₄ SiO ₄
732	3.000E-01	-5.51	y	/SO ₄ -2
490	4.020E+00	-3.65	y	/NH ₄ +1
100	2.200E-02	-6.80	y	/Ba+2
270	5.600E-01	-4.53	y	/F-1
280	1.100E-01	-5.71	y	/Fe+2
470	5.500E-02	-6.00	y	/Mn+2
540	2.300E-03	-7.41	y	/Ni+2
492	1.300E-01	-5.68	y	/NO ₃ -1
800	1.400E-02	-6.80	y	/Sr+2
580	1.350E+00	-4.85	y	/PO ₄ -3
145	1.050E-06	-5.98		/DOM

3 1

330 8.9400 0.0000 /H+1

6 1

8913304 -13.1200 30.2450 /U(OH)₅ -1

GEOCHEMICAL CALCULATIONS FOR R12 (507 FT).

SAMPLED ON 09/19/00.

23.60 MG/L 0.000 0.00000E-01

1 0 1 0 3 0 0 0 1 1 0 0 0

0 0 0

330	0.000E-01	-8.62	y	/H+1
140	3.837E+01	-4.91	y	/Total CO ₃ -2 alkali
150	1.500E+01	-3.43	y	/Ca+2
460	3.000E+00	-3.91	y	/Mg+2
500	9.400E+00	-3.39	y	/Na+1
410	2.100E+00	-4.27	y	/K+1
180	6.700E+00	-3.72	y	/Cl-1
770	4.770E+01	-3.30	y	/H ₄ SiO ₄
732	7.700E+00	-4.10	y	/SO ₄ -2
100	1.600E-02	-6.93	y	/Ba+2
270	4.300E-01	-4.65	y	/F-1
470	1.800E-01	-5.48	y	/Mn+2
800	6.800E-02	-6.11	y	/Sr+2
891	4.600E-04	-8.71	y	/U+4
893	5.200E-04	-8.72	y	/UO ₂ +2
580	8.990E-01	-5.02		/PO ₄ -3

3 1

330 8.6200 0.0000 /H+1

6 1

8913304 -13.1200 30.2450 /U(OH)₅ -1

GEOCHEMICAL CALCULATIONS FOR R-12 (507 FT).

SAMPLED ON 03/15/01.

13.20 MG/L 0.000 0.00000E-01

1 0 1 0 3 0 0 0 1 1 0 0 0

0 0 0

330	0.000E-01	-6.91 Y	/H+1
140	4.017E+01	-19.86 Y	/Total CO ₃ -2 alkali
150	1.500E+01	-3.43 Y	/Ca+2
460	2.500E+00	-3.99 Y	/Mg+2
500	9.400E+00	-3.39 Y	/Na+1
410	2.200E+00	-4.25 Y	/K+1
180	6.700E+00	-3.72 Y	/Cl-1
770	4.800E+01	-3.30 Y	/H ₄ SiO ₄
732	8.100E+00	-4.07 Y	/SO ₄ -2
100	1.500E-02	-6.96 Y	/Ba+2
270	4.900E-01	-4.59 Y	/F-1
470	6.000E-02	-5.96 Y	/Mn+2
540	8.000E-04	-7.87 Y	/Ni+2
800	6.500E-02	-6.13 Y	/Sr+2
580	2.200E-01	-5.64 Y	/PO ₄ -3
891	6.600E-04	-8.56 Y	/U+4
893	7.500E-04	-8.56 Y	/UO ₂ +2

3 1

330 6.9100 0.0000 /H+1

6 1

8913304 -13.1200 30.2450 /U(OH)5 -1

GEOCHEMICAL CALCULATIONS FOR R-12 (507 FT).

SAMPLED ON 06/13/01.

19.90 MG/L 0.000 0.00000E-01

1 0 1 0 3 0 0 0 1 1 0 0 0

0 0 0

330	0.000E-01	-8.63	y	/H+1
140	3.777E+01	-19.88	y	/Total CO ₃ -2 alkali
150	1.400E+01	-3.46	y	/Ca+2
460	2.000E+00	-4.08	y	/Mg+2
500	9.000E+00	-3.41	y	/Na+1
410	2.100E+00	-4.27	y	/K+1
180	5.900E+00	-3.78	y	/Cl-1
770	5.140E+01	-3.27	y	/H ₄ SiO ₄
732	8.500E+00	-4.05	y	/SO ₄ -2
490	4.000E-01	-4.65	y	/NH ₄ +1
100	1.100E-02	-7.10	y	/Ba+2
270	5.300E-01	-4.55	y	/F-1
470	3.400E-02	-6.21	y	/Mn+2
492	2.200E-01	-5.45	y	/NO ₃ -1
800	6.100E-02	-6.16	y	/Sr+2
580	2.060E-01	-5.66	y	/PO ₄ -3
891	4.300E-04	-8.74	y	/U+4
893	4.900E-04	-8.74	y	/UO ₂ +2

3 1

330 8.6300 0.0000 /H+1

6 1

8913304 -13.1200 30.2450 /U(OH)₅ -1

GEOCHEMICAL CALCULATIONS FOR R-12 (507 FT).

SAMPLED ON 09/10/01.

21.30 MG/L 0.000 0.00000E-01

1 0 1 0 3 0 0 0 1 1 0 0 0

0 0 0

330	0.000E-01	-8.94	y	/H+1
140	3.177E+01	-19.96	y	/Total CO ₃ -2 alkali
150	1.500E+01	-3.43	y	/Ca+2
460	1.900E+00	-4.11	y	/Mg+2
500	1.110E+01	-3.32	y	/Na+1
410	1.980E+00	-4.30	y	/K+1
180	4.380E+00	-3.91	y	/Cl-1
770	4.960E+01	-3.29	y	/H ₄ SiO ₄
732	7.650E+00	-4.10	y	/SO ₄ -2
490	3.500E-01	-4.71	y	/NH ₄ +1
100	1.300E-02	-7.02	y	/Ba+2
270	4.000E-01	-4.68	y	/F-1
470	4.300E-02	-6.11	y	/Mn+2
492	3.100E-01	-5.30	y	/NO ₃ -1
800	5.800E-02	-6.18	y	/Sr+2
580	2.760E-01	-5.54	y	/PO ₄ -3
891	1.400E-04	-9.23	y	/U+4
893	1.600E-04	-9.23	y	/UO ₂ +2

3 1

330 8.9400 0.0000 /H+1

6 1

8913304 -13.1200 30.2450 /U(OH)₅ -1

GEOCHEMICAL CALCULATIONS FOR R-12 (811 FT).

SAMPLED ON 09/20/00.

22.50 MG/L 0.000 0.00000E-01

1 0 1 0 3 0 0 0 1 1 0 0 0

0 0 0

330	0.000E-01	-7.24	y	/H+1
140	1.019E+01	-5.91	y	/Total CO ₃ -2 alkali
150	4.100E+01	-2.99	y	/Ca+2
460	9.900E+00	-3.39	y	/Mg+2
500	1.800E+01	-3.11	y	/Na+1
410	4.400E+00	-3.95	y	/K+1
180	1.000E+01	-3.55	y	/Cl-1
770	8.860E+01	-3.04	y	/H ₄ SiO ₄
732	1.600E+01	-3.78	y	/SO ₄ -2
100	1.100E-01	-6.10	y	/Ba+2
270	2.700E-01	-4.85	y	/F-1
280	7.400E-01	-4.88	y	/Fe+2
470	1.100E+00	-4.70	y	/Mn+2
540	4.900E-02	-6.08	y	/Ni+2
800	2.100E-01	-5.62	y	/Sr+2
891	3.300E-04	-8.86	y	/U+4
893	3.700E-04	-8.86	y	/UO ₂ +2

3 1

330 7.2400 0.0000 /H+1

6 1

8913304 -13.1200 30.2450 /U(OH)5 -1

GEOCHEMICAL CALCULATIONS FOR R-12 (811 FT).

SAMPLED ON 03/16/01.

19.90 MG/L 0.000 0.00000E-01

1 0 1 0 3 0 0 0 1 1 0 0 0

0 0 0

330	0.000E-01	-6.83	y	/H+1
140	1.079E+02	-19.43	y	/Total CO ₃ -2 alkali
150	4.300E+01	-2.97	y	/Ca+2
460	1.000E+01	-3.39	y	/Mg+2
500	1.700E+01	-3.13	y	/Na+1
410	4.600E+00	-3.93	y	/K+1
180	9.300E+00	-3.58	y	/Cl-1
770	9.580E+01	-3.00	y	/H ₄ SiO ₄
732	1.100E+01	-3.94	y	/SO ₄ -2
100	1.400E-01	-5.99	y	/Ba+2
270	3.200E-01	-4.77	y	/F-1
280	2.700E-01	-5.32	y	/Fe+2
470	6.600E-01	-4.92	y	/Mn+2
540	1.100E-02	-6.73	y	/Ni+2
800	2.300E-01	-5.58	y	/Sr+2
891	1.250E-03	-8.28	y	/U+4
893	1.400E-03	-8.29	y	/UO ₂ +2

3 1

330 6.8300 0.0000 /H+1

6 1

8913304 -13.1200 30.2450 /U(OH)5 -1

GEOCHEMICAL CALCULATIONS FOR R-12 (811 FT).

SAMPLED ON 06/14/01.

22.30 MG/L 0.000 0.00000E-01

1 0 1 0 3 0 0 0 1 1 0 0 0

0 0 0

330	0.000E-01	-7.43 y	/H+1
150	4.600E+01	-2.94 y	/Ca+2
460	1.100E+01	-3.34 y	/Mg+2
500	1.700E+01	-3.13 y	/Na+1
410	4.600E+00	-3.93 y	/K+1
180	9.300E+00	-3.58 y	/Cl-1
770	9.580E+01	-3.00 y	/H4SiO4
732	1.000E+01	-3.98 y	/SO4-2
100	1.000E-01	-6.14 y	/Ba+2
270	4.700E-01	-4.61 y	/F-1
470	5.500E-01	-5.00 y	/Mn+2
540	9.800E-03	-6.78 y	/Ni+2
800	2.300E-01	-5.58 y	/Sr+2
891	1.950E-03	-8.09 y	/U+4
893	2.200E-03	-8.09 y	/UO2+2
140	1.073E+02	-5.68 y	/Total CO3-2 alkali

3 1

330 7.4300 0.0000 /H+1

6 1

8913304 -13.1200 30.2450 /U(OH)5 -1

GEOCHEMICAL CALCULATIONS FOR R-12 (811 FT).

SAMPLED ON 09/12/01.

25.80 MG/L 0.000 0.00000E-01

1 0 1 0 3 0 0 0 1 1 0 0 0

0 0 0

330	0.000E-01	-7.57 y	/H+1
150	4.400E+01	-2.96 y	/Ca+2
460	1.040E+01	-3.37 y	/Mg+2
500	1.830E+01	-3.10 y	/Na+1
410	4.300E+00	-3.96 y	/K+1
180	8.810E+00	-3.60 y	/Cl-1
770	9.250E+01	-3.02 y	/H4SiO4
732	1.340E+01	-3.86 y	/SO4-2
100	1.450E-01	-5.98 y	/Ba+2
270	3.700E-01	-4.71 y	/F-1
470	3.400E-01	-5.21 y	/Mn+2
540	4.800E-03	-7.09 y	/Ni+2
492	4.400E-02	-6.15 y	/NO3-1
800	2.310E-01	-5.58 y	/Sr+2
580	1.530E-01	-5.79 y	/PO4-3
891	1.940E-03	-8.09 y	/U+4
893	2.200E-03	-8.09 y	/UO2+2
140	1.025E+02	-5.55 y	/Total CO3-2 alkali

3 1

330 7.5700 0.0000 /H+1

6 1

8913304 -13.1200 30.2450 /U(OH)5 -1

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